

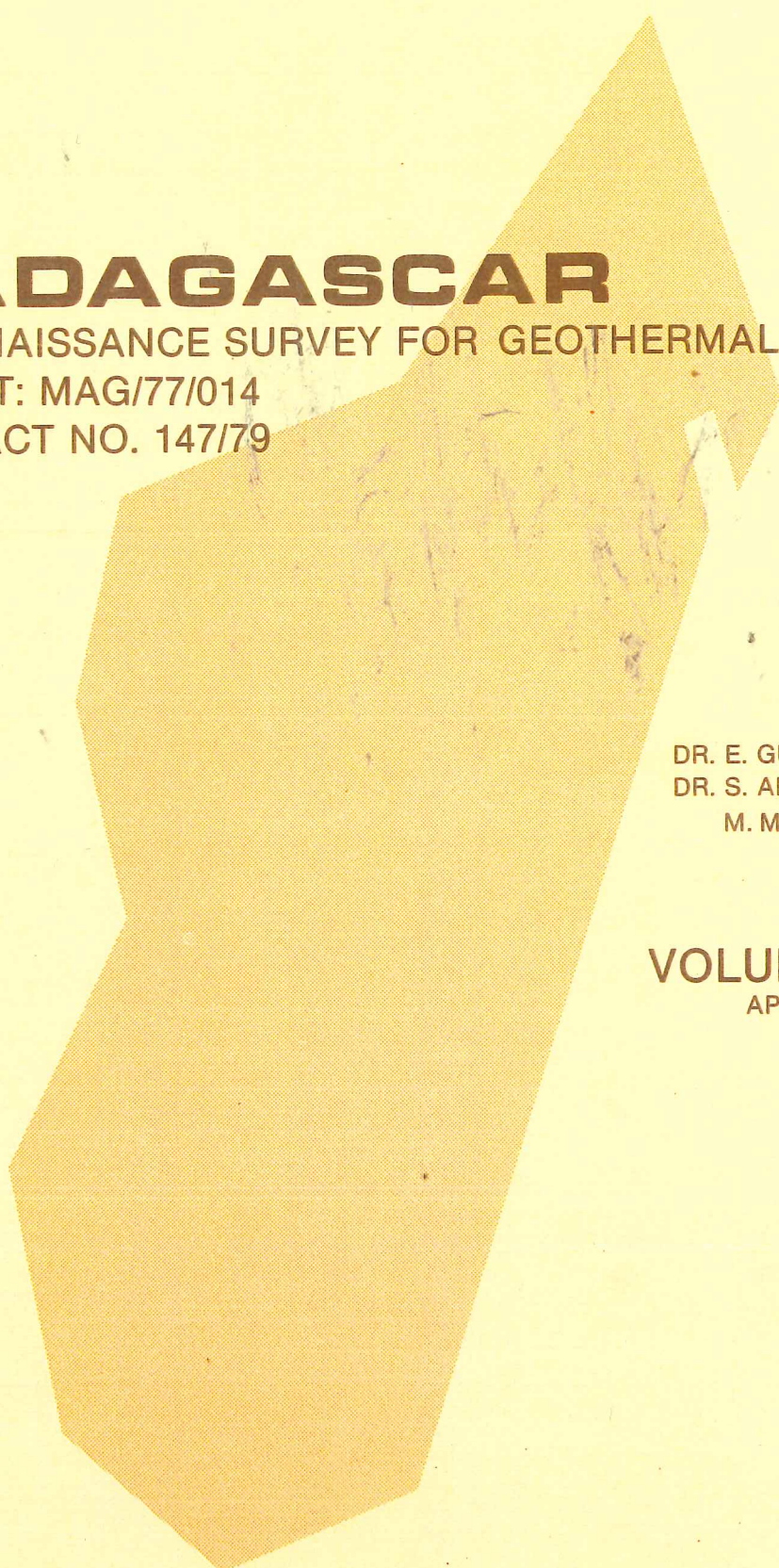
UNITED NATIONS

MADAGASCAR

RECONNAISSANCE SURVEY FOR GEOTHERMAL RESOURCES

PROJECT: MAG/77/014

CONTRACT NO. 147/79



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VOLUME 2 OF 2
APPENDICES

VIRKIR

CONSULTING GROUP LTD

REYKJAVIK

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Appendix 1. Location of geothermal manifestations.

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Appendix 1.1 List of maps made available to Virkir.



Maps made available to Virkir during the Geochemical Reconnaissance Survey.

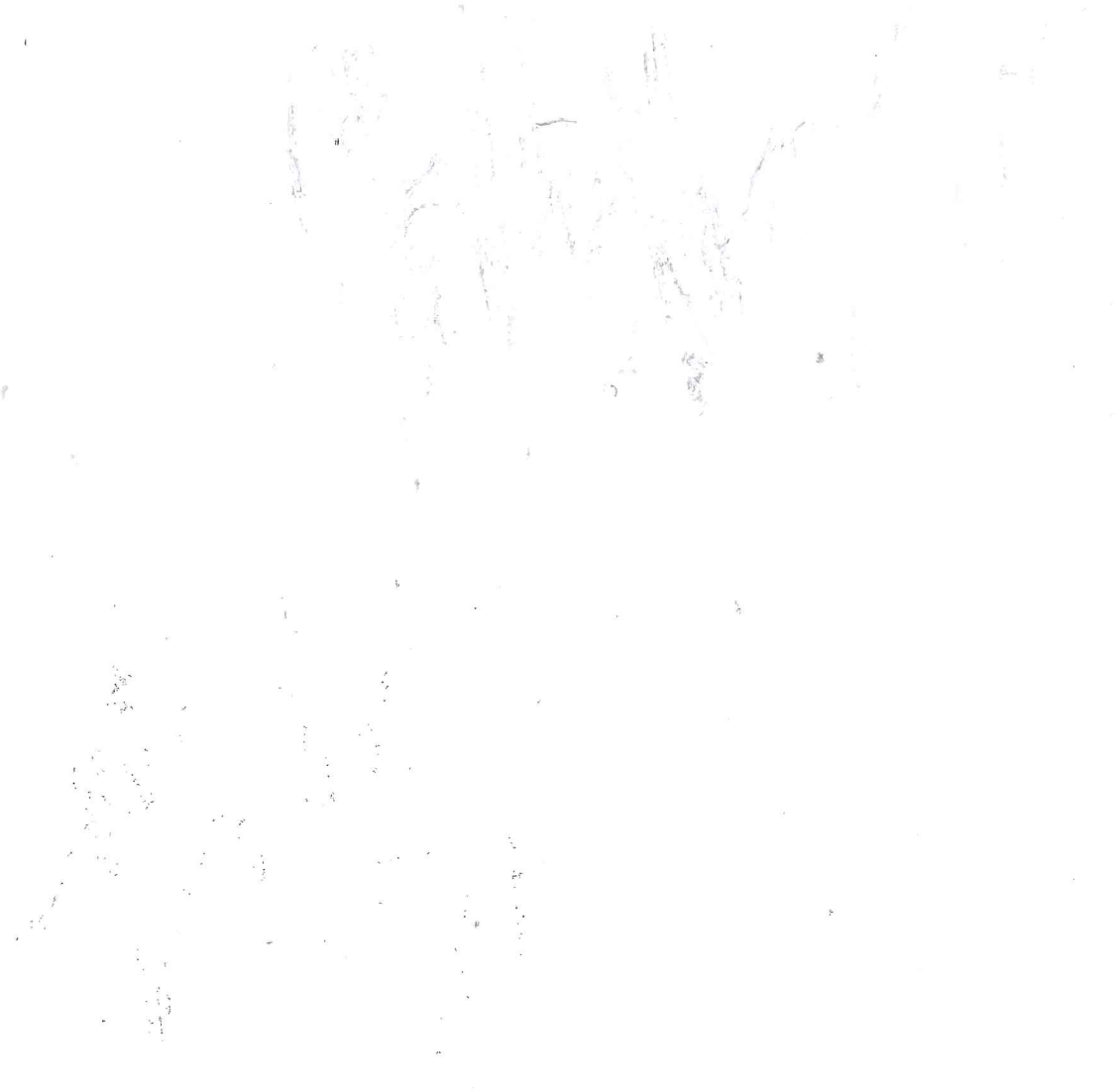
Topographical maps.

<u>Sheet</u>		<u>Scale</u>
L 60	Mahaly	1:100.000
L 61	Tranomaro	1:100.000
M 60	Esira	1:100.000
M 61	Andranodambo	1:100.000
N 60	Marovitsika	1:100.000
N 61	Ranomafana du Sud	1:100.000
S 34	Ambanja	1:100.000
U 32	Ambilobe	1:100.000
U 33	Ambakirano	1:100.000
U 46	Anivarano Sud	1:100.000
U 47	Brickaville	1:100.000
V 35	Anjialavabe	1:100.000
V 36	Ambodisatrana	1:100.000
V 46	Tampina	1:100.000
W 35	Doany	1:100.000
W 36	Andapa	1:100.000
2	Diego Suarez	1:500.000
3	Majunga	1:500.000
4	Antalaha	1:500.000
5	Maintirano	1:500.000
6	Tamatave	1:500.000
7	Morondava	1:500.000
8	Tananarive	1:500.000
9	Tuléar	1:500.000
10	Fianarantsoa	1:500.000
11	Ampanihy	1:500.000
12	Fourt Dauphin	1:500.000

Geological maps

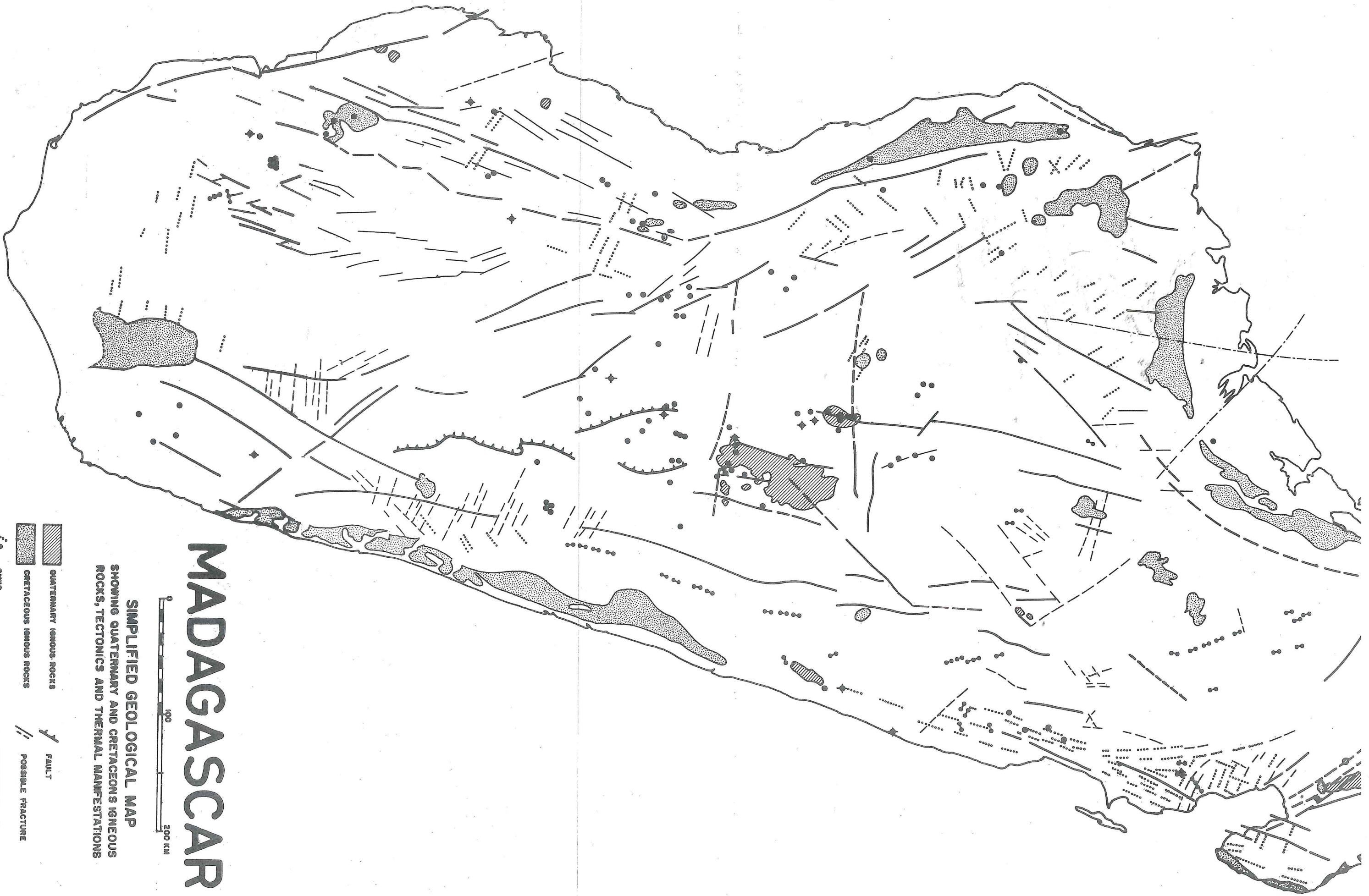
<u>Sheet</u>		<u>Scale</u>
L 61	Tranomaro	1:100.000
M 47	Soavinandriana	1:100.000
N 48	Faratsiho	1:100.000
N 49	Antsirabe	1:100.000
N 47 O 47	Miarinarivo & Arivonimamo	1:100.000
N 61	Ranomafana du Sud	1:100.000
U 32 V 32	Ambilobe & Betsiaka	1:100.000
U 33 V 33	Ambakirano & Ambohibada	1:100.000
U 46	Anivorano Sud	1:100.000
	Nosy Be	1:100.000
L 60 M 60	Mahaly & Esira	1:100.000
V.W 36 37	Andapa	1:200.000
V.W 34 35	Andravory	1:200.000
T 47 U 47	Ranomafana & Brickaville	1:100.000
N 60	Marovitsika (Photogeological map)	
Madagascar	3 sheets	1:1.000.000

Appendix 1.2 Map showing locations of geothermal manifestations.



Appendix 1.3 Simplified geological map.












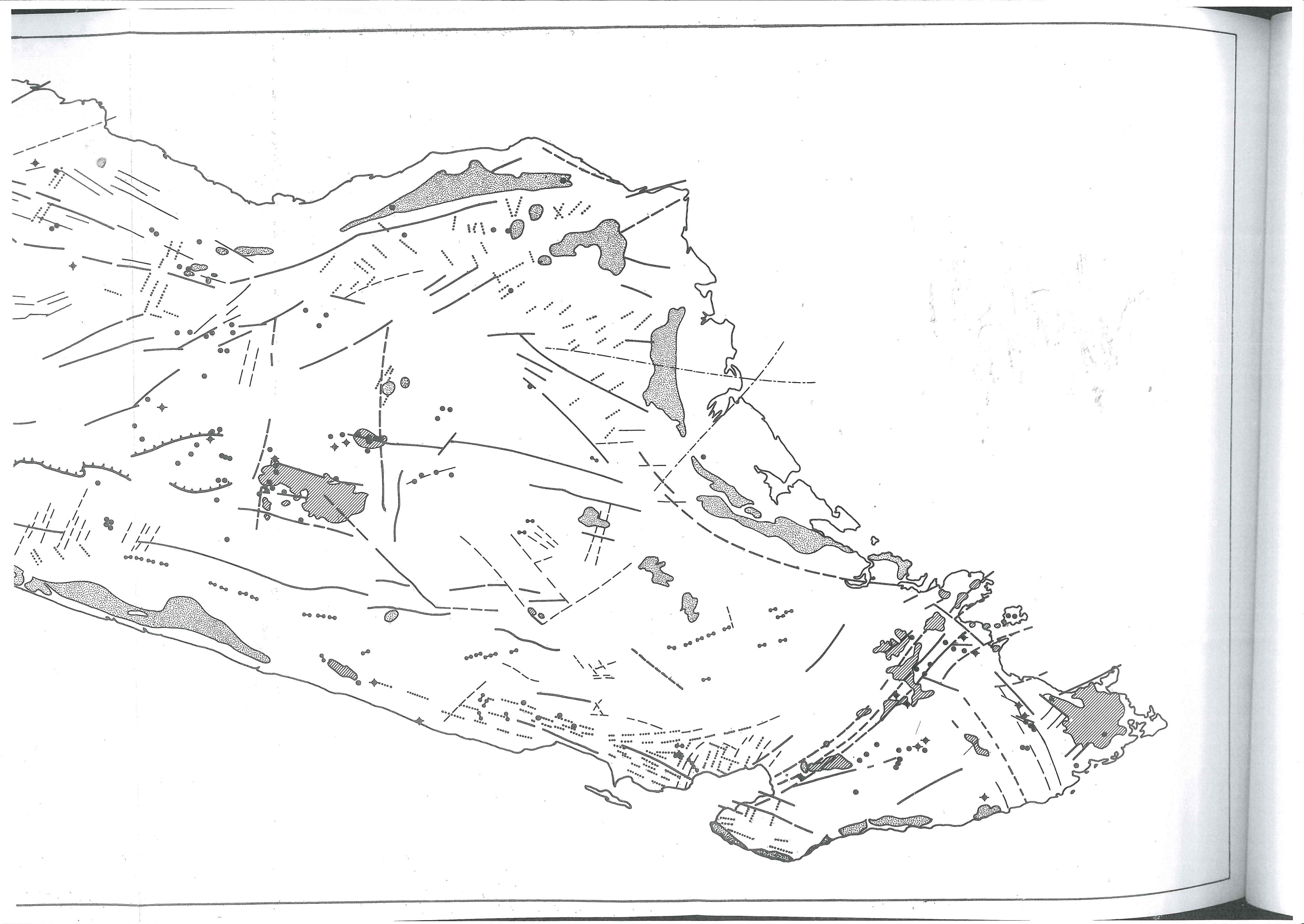


MADAGASCAR

SIMPLIFIED GEOLOGICAL MAP
 SHOWING QUATERNARY AND CRETACEOUS IGNEOUS
 ROCKS, TECTONICS AND THERMAL MANIFESTATIONS



-  QUATERNARY IGNEOUS ROCKS
-  CRETACEOUS IGNEOUS ROCKS
-  FAULT
-  POSSIBLE FRACTURE
-  SITE SAMPLED
-  SITE NOT SAMPLED
-  GEOTHERMAL MANIFESTATION
-  DYKE
-  MAJOR FRACTURE



Appendix 1.4 Location of geothermal manifestations.



Location	number	map no 1:500.000	Longitude.	Latitude.	chapter.
Antsirabe, source de lac	790001	8	47°02'	19°52'	7.13
Antsirabe, source de l'hospital	790002	8	47°02'	19°52'	7.13
Antsirabe, source de Ranovisy	790003	8	47°02'	19°52'	7.13
Antsirabe, source de Ranomafana II	790004	8	47°02'	19°52'	7.13
Ranomafana de Betafo	790005	7	46°50'	19°50'	7.13
Andronatsara-Antsira	790006	8	47°08'	19°46'	7.13
Andranomafana Ambatofinandiakana	790007	7	46°47'	20°31'30"	7.16
Itasy, Andranomafana Soavinaudriana	790008	7	46°39'	19°12'	7.12
Itasy, Andranomafana Mashoma	790009	7	46°43'	19°15'30"	7.12
Itasy, Andranoriantotraka	790010	7	46°38'	18°55'30"	7.12
Itasy, source d'Ambaraky	790011	7	46°39'30"	18°56'	7.12
Itasy, source des mocain d'Ifanja	790012	7	46°45'	18°53'	7.12
Source de region d'Ambalobe	790013	2	49°07'	13°14'	7.2
Andranomafana Betsiraka	790014	2	49°15'	13°08'	7.2
Andranomafana Ambobaka	790015	4	48°30'	14°14'	7.4
Andranomafana Migioky	790016	4	48°31'	14°05'	7.4
Ankazohely	790017	4	48°32'	13°47'	7.4
Maevadoany	790018	4	48°39'	14°02'	7.4
Beangona Amporiana	790019	4	48°42'	14°04'	7.4
Ampatamasina	790020	4	48°42'	14°02'	7.4
Andranomandevy	790021	2	49°32'	12°15'	7.1
Sakaramy	790022	2	49°17'	12°27'	7.1
Ampahaka	790023	2	49°11'	13°11'	7.2
Andranomafanakely	790024	2	49°24'	13°10'	7.2
Andranomafanabe	790025	2	49°24'	13°11'	7.2
Ranomafana-Est - Tamatave	790026	8	48°51'	18°57'	7.10
Miarinavaratra	790027	8	47°34'	20°15'	7.18

Location	number	map no 1:500.000	Longitude.	Latitude.	chapter.
Ranomafana Ifanadiana (Source S1b)	790028	10	47°27'	21°14'	7.17
Ranomafana Ifanadiana (Source S1a)	790029	10	47°27'	21°14'	7.17
Ranofamana Ifanadiana (Source 2a)	790030	10	47°27'	21°14'	7.17
Ranomafana Ifanadiana (Source 2b)	790031	10	47°27'	21°14'	7.17
Andranomafana Andonaky	800032	9	44°26'	21°52'	7.19
Andranomafana (Amokoty)	800033	9	44°22'	21°50'30"	7.19
Miary Ranomafana	800034	9	44°15'	22°55'	7.20
Ranomafana Andrambo	800035	9	44°22'	23°03'	7.20
Ranomafana Andravidahy	800036	9	44°16'30"	23°01'	7.20
Ranomafana Tsaripioka	800037	9	44°03'	21°54'	7.19
Ranomafana Serp	800038	9	44°30'	23°30'	7.20
Ranomafana Devolimanga	800039	9	44°30'	23°30'	7.20
Ranomafana (fiscine)	800040	9	44°30'	23°30'	7.20
Ranomafana Raingile	800041	9	44°30'	23°30'	7.20
Ranomafana Ambilanisaba	800042	9	44°30'	23°30'	7.20
Ranomay (Tongobory)	800043	9	44°20'	23°34'	7.20
Tsiefa Andranomafana	800044	7	46°27'	21°01'	7.15
Ranomafana Fitampilo	800045	7	46°20'	20°57'30"	7.15
Andranomafana Mohicavina	800046	10	47°05'	21°19'	7.17
Andranomafana Angaradoa dit Analamaizina	800047	7	45°28'	19°33'	7.15
Source d'Andranomafanananadiana	800048	6	46°59'30"	18°34'30"	7.11
Source d'Antsira	800049	6	47°03'	18°36'	7.11
Ranomafana d'Anjohibe	800050	6	46°57'	18°21'	7.11
Ranomafana de Sahalolo	800051	6	46°58'30"	18°31'	7.11
Mahatsinjs Ambohipano	800052	7	46°39'30"	18°52'	7.12
Ranomafana Anosibe	800053	7	46°39'	18°51'	7.12
Ramainandro	800054	8	47°0'30"	19°17'	7.12

Location	number	map no 1:500.000	Longitude.	Latitude.	chapter.
Henikenina Quest	800055	8	47°02'	20°15'	7.16
Henikenina Est	800056	8	47°03'	20°15'30"	7.16
Andranonafana Vohidambo	800057	8	47°15'	20°17'	7.18
Ranomafana Tsangandrano	800058	7	46°43'30"	20°16'	7.16
Ranomafana Ampasimihebo	800059	7	46°43'	20°15'	7.16
Ranomafana Kelipetaka	800060	7	46°45'	20°17'	7.16
Ranomafana d'Antsira	800061	7	46°51'	20°14'	7.16
Ranomafana Laondany	800062	7	46°51'30"	20°11'	7.16
Ranomafana Langainony	800063	7	46°51'	20°09'	7.16
Ranomafana Sahavatoana	800064	7	46°44'	20°27'	7.16
Ranomafana Imody	800065	7	46°49'	20°58'30"	7.16
Ambohibato	800066	7	46°51'30"	20°37'	7.16
Mahasoa	800067	7	47°06'30"	20°32'	7.15
Mafana	800068	7	45°53'	20°13'	7.15
Antsirrasira	800069	7	45°53'	20°12'	7.15
Ambia-Quest	800070	7	45°38'30"	20°15'	7.15
Ambia-Sud-Est	800071	7	45°40'	20°17'	7.15
Antsira	800072	7	45°45'30"	20°37'	7.15
Kiposa	800073	7	45°46'	20°32'30"	7.15
Ranomafana de Bevoho on Ansrotsy	800074	7	49°59'	20°38'	7.14
Vongoho	800075	7	49°59'	20°38'	7.14
Analabe	800076	7	45°33'	19°22'	7.15
Andranomandevy	800077	7	45°40'	20°09'	7.15
Amerobe	800078	7	45°26'	19°18'	7.15
Ranomafana Marantsandry	800079	6	49°18'	17°15'	7.9
Ranomafana Vohitsara	800080	6	49°23'	17°11'	7.9
Ranomafana Ambilanifotsialana	800081	6	49°21'30"	17°0'	7.9

Location	number	map no 1:500.000	Longitude.	Latitude.	chapter.
Ranomafana Vohibato	800082	6	49°21'	17°01'	7.9
Ranomafana Doany	800083	4	49°32'	14°21'30"	7.5
Androranga	800084	4	49°39'	14°17'30"	7.5
Andranomlolo	800085	4	49°27'	14°20'30"	7.5
Andranomafanahely-Doany	800086	4	49°28'30"	14°23'	7.5
Ankiakabe	800087	4	49°29'	14°11'	7.5
Ranomafana Andranomadio	800088	4	49°28'	14°05'	7.5
Ranomafana d'Ambodiantezoka	800089	4	49°53'	14°47'	7.5
Ranomafana d'Andramonta	800090	4	49°21'	14°35'	7.5
Ranomafana de Marolakana	800091	4	49°38'	14°47'30"	7.5
Ranomafana Antsasaka	800092	4	49°39'	14°47'	7.5
Soatanimbary	800093	7	45°39'	20°09'	7.15
Mahobo	800094	7	44°43'	20°22'	7.14
Soatanana	800095	7	44°45'30"	20°55'	7.14
Ambango	800096	7	44°42'	20°50'	7.14
Emitray	800097	11	46°41'	24°16'	7.21
Betaimboraka	800098	12	46°59'30"	24°25'30"	7.21
Marosanoa	800099	11/12	46°56'	24°34'	7.21
Sarongaha	800100	12	47°00'30"	24°28'	7.21
Folakara	800101	5	45°05'	17°42'	7.8
Antanandava	800102	5	44°46'	17°49'30"	7.8
Berohay	800103	5	44°47'	17°54'	7.8
Ampoza Bebai	800104	5	44°23'	17°30'	7.8
Ankilimahasoa	800105	7	44°29'	18°45'	7.8
Benmonto	800106	5	44°24'	18°34'	7.8
Tabalahely (Nosy Be)	800107	2	48°15'	13°21'	7.3
Tabalahoriko (Nosy Be)	800108	2	48°13'30"	13°23'	7.3

Location	number	map no 1:500.000	Longitude.	Latitude.	chapter.
Bejofo	800109	4	48°21'	13°46'	7.4
Sahasaroetra	800110	7	46°47'	19°27'	7.12
Antsirabe (Source froide)	800111	8	47°02'	19°52'	7.13
Antsirabe (eu domestique)	800112	8	47°02'	19°52'	7.13
Malailay	800113	5	46°34'	18°21'	7.11
Malailay	800114	5	46°34'	18°18'	7.11
Ranomafanai Ankohabe	800115	5	46°45'	18°33'	7.11
Ranomafana d'Andasibe	800116	5	46°16'	17°49'30"	7.7
Source de Sainte-Marie	800117	4	47°21'	16°08'	7.6

Appendix 1.5 Description of sample sites.

Antsirabe, source de lac

0001

Location:

On the eastern side of the lake Ranomafana in the center of the town Antsirabe, about 30 m from the bank of the lake, 300 m from the "établissement thermal", in front of the building of A 270, and named "Source du lac". The "établissement thermal" is supplied by another thermal spring, which is no 0004, called Ranomafana II.

Remarks:

Cold water comes from the rice fields, just north of the spring and flows close to it. The lake is partly supplied by the spring 0001.

Antsirabe, source de l'hospital

0002

Location:

In the center of the town Antsirabe, north-east of the hospital, on the road to the Ranovisy-spring. South of the lake Ranomafana, turn to south from the road to Ranovisy-spring and turn again, to right after 30 m, and you arrive at the "station thermale". This is a group of bathing huts.

Remarks:

CaCO₃ deposits are about to block the exit of the water.

Antsirabe, source de Ranovisy

0003

Location:

North of the swimming pool of Ranomafana, which it supplies, and south of Ampatana (?). In town's center. You get there, either from the crossroad south of the lake Ranomafana, or by passing through the village Ambavahadimangatsiaku. The spring is in a small house.

Remarks:

CaCO₃ deposits are about to blok the exit of the water.

Antsirabe, source de Ranomafana II

0004

Location:

In town's center and it supplies the 100 years-old "établissement thermale" of Antsirabe.

Remarks:

CaCO₃ deposits frequently cause problems in the piping system, the water must therefore be pumped to the "établissement".

Ranomafana de Betafo

0005

Location:

At the "station Thermale", about 3,5 km west of the town Betafo, 70 m south of the road to Miandrivazo.

Remarks:

The water emerges from fissures in basalt. There are outcrops of scoria in a large radius around the spring.

Andronatsara-Antsira

0006

Location:

In a bed of a small river, with 2 parallel tubes. About 500 m north of Andramotsara, on the R.N. 7 in direction to Antananarivo.

Remarks:

The spring is fitted with drilling pipes (tubes) where the water emerges. There is cold water around, which cools down the spring's water. It is a mineral spring.

Andranomafana Ambatofinandiakana

0007

Location:

4 km north-west of the town Ambatofinandrahana. From the town a gravel road leads to the more or less abandoned "station Thermale".

Remarks:

The water emerges from a number of outlets, but only 3 of them are used for the baths. It must be noted that cold water, that comes from the hatchery (station piscicole) above the "station thermale" flows through the thermal area.

Itasy, Andranomafana Soavinandriana

0008

Location:

In the village Andranomafana, at the confluence of the rivers Kelimahery and Mangadona. There is a number of springs, one of them is in the bed of the river Mangadona and the others in that of the river Kelimahery.

Access to the springs: when coming from Soavinandriana on the way to Mahasolo, and immediately after the bridge B.A., 500 m before the entrance to Mananasy, turn to left over another bridge, continue for about 10 km towards the lake Ambatoeha. From there, either on foot around the lake from east, or if driving, then from west, it is a steep climb and after that the road descends again to the village Andranomafana. It is a narrow track, which is the continuation of the road from the bridge of Mananasy. It is about 3 km long.

Our sample is from the spring in the bed of Mangadona.

Remarks:

The water emerges from the rocks and flows directly into Kelimahery or Mangadona.

Itasy, Andranomafana Mashoma

0009

Location:

In the Firandranama de Soavinondirana. Firaisana de Masindray is in south. West of the town Soavinondirana. Take the road to Masindray, 15 km long, and you can reach the spring by two means:
- by car to Masindray and then 3 hours walk to south.
- by car 10 km on the road to Masindray. When arriving in Tsaramasandro, turn to right and drive about 13 km, passing the following villages: Amparibohitra, Belariatra and Befaritra, from where the lakes Pilina and Befaritra can be seen, but they are south of the spring. From Befaritra follow a bad track to the village Antsoropanana, passing north of Antanetilava and through Antsargosongo. The spring is about 15 minutes walk south of Antsoropanana.

The spring is in a narrow valley at the southern base of the hill Ambatomira, in the bed of the river Maratohala, left tributary of Kitsandry. The mountain Masahona is to the west, the new village Soamanarivo on the east. The spring is about 500 m from the confluence of Kitsamby and Maratohala in Maratohala.

Remarks:

Thick calcareous deposits surround the thermal area. The spring supplies the brook Marotahala. The addition of HCl to 100 ml of sample releases big quantities of carbonic gases.

Itasy, Andranoriantotraka

0010

Location:

Thermal area with 3 geysirs is in the Monloup quarry. Follow the R.N. 1 from Anaalvory and turn on the old road of Tsiroanomandidy, continue for about 7 km passing through the village Amparaly. The road of Tsiromandidy (Tsiroanomandidy?) crosses the river Mazy on a B.A. bridge, continue for about 600 m and turn to left to the road of the quarry, or right at a tree called Amontana. The quarry is 1 km further on, on the bank of the river Mazy. The 3 geysirs emerge on the left bank of the river Mazy on a platform of aragonite.

Remarks:

Thick calcareous deposits surround the geysirs. The vegetation around is petrified by the deposits. The water column can reach 3 m, but is 2,5 on the average.

Itasy, source d'Ambaraky

Location:

This is a cold mineral spring on the old road to Tsiroanomandidy, about 500 m from the bridge over the river Mazy. The water emerges in a rice field on the left side of the road, at a bend and in an area adjacent to an irrigation canal.

Remarks:

The well is muddy and the samples can be contaminated.

Itasy, source des mocain d'Ifanja

0012

Location:

The spring is in the middle of the Ifanja marsh. About 1 km south of the village Anosibe, in the middle of the marsh and in the "zozoro". There are 3 springs.

Access to Anosibe is possible from Analavory: take the first turning to right after the crossroad to Itasy. The road passes through Ingilomby (dangerous descent), 5 km further along the right bank of the Ifanja marsh and crosses the river Andranovaky.

Remarks:

The springs are in a marshland bordered with zozoro (water plants). The water is contaminated.

Source de region d'Ambalobe

0013

Location:

On the road from Ambilobe heading to Ambakirano, one reaches Ankimadoso 10 km from the junction Diego-Suarez. At the other end of the village, turn right to the village Ambatobe and in its southern part turn to right and continue until you reach a point, where you see a marsh area in the west, about 1 km in diameter.

The springs are on the NE side of this marsh. There are 2 springs 10 m apart, SE of the mountain Ambohipiraka.

Remarks:

Water is contaminated and muddy.

Andranomafana Betsiraka

0014

Location:

On the road from Ambilobe to Vohemar, 23 km from the crossing with the Diego-Suarez road, 2 km from the village Betsiaka. After you leave Betsiaka, cross 6 little bridges, then take the road to the left and 1 km later you arrive at the spring.

There are 4 springs that form a brook. They are not far from the old goldmine of Andavovera.

Remarks:

Little calcareous deposits. One spring is fitted with a discharge pipe (sampling bulb?), but the pressure does not permit the water to flow out of the pipe.

Andranomafana Ambobaka

0015

Location:

On the road to Bas-Sambriano (Lower -Sambriano) in the direction of Marovato. The spring is on the bank of the river Ramena, about 500 m from the road where it crosses the river, and to the right of the new village Ambobaka. It is on the left bank of the river Ramena and is mixed with the river water.

Remarks:

The water is contaminated. The discharge of the spring cannot be estimated, since the spring emerges into the riverbed and its water mixes with the river.

Andranomafana Migioky

0016

Location:

2 km from Migioky on the track to Antanambiron. Ambahatra is on the right side of the road. In the plain irrigated by the river Sambirano. There are springs dispersed on a calcareous hill, in the middle of a longozo and fern forest, which must be passed.

Remarks.

Thick calcareous deposits have built up a small hill, in which there are water producing fractures. 7 earlier exits have been blocked under pressure. Along one fracture, water can be heard flowing underground.

Ankazohely

0017

Location:

About 20 km SE of the village Ambobaka. This village is on the other side of the metallic bridge on the river Ramena. From there, there is a 3 hours walk to the spring, going through the villages Ankazobe and Ankazohely.

Remarks:

We noticed a lot of springs below rock piles. The water forms a 100 m² big pool and flows to a kind a platform 1 m lower. Then it flows into the small river Ankazohely, which becomes warm. The area is surrounded by high trees, some of them over 30 m.

Maevadoany

0018

Location:

From the village Maevadoany, which is within Firaisamfokantany de Marotolana, one passes the river Sambirano by canoe and walks for an hour on a track to the village Andranomafana.

The spring is 100 m south of that small village at the base of the hill called "Bongo d'Andranomafana".

Remarks:

The spring is circular (50 cm in diameter) and emerges in a coarse grained sand layer and emits a lot of gas bubbles. It flows after that through a small canal 20 cm wide, 5 cm deep, which leads it to the river Sambirano 70 m lower. This place, considered by the inhabitants as sacred, has been freed of brushwood and even enclosed. The surrounding vegetation is especially liana and fern.

Beangona amporiana

0019

Location:

Two km south of the village Beangona amporiana, on the left river side of Sambirano. From Mevadoany, which is the last accessible village by car, there is a 3 hours walk to the spring, passing through the village Beangona ambery.

Remarks:

Several springs emerge from below a pile of rock (quartzite). The water gathers together a little lower and forms a brook, which flows around a heap of stones and after that into the river Beangona, that passes 60 m away. The place forms a kind of basin 20 m in diameter, 2 m deep and its arranged walls are made of hard rocks. The water from the spring is appreciated by the cattle.

Ampatamasina

0020

Location:

2 km north of the village Beangona ambery. After having crossed the river Sambirano, follow a track on the side of the hill Ampatamasina.

Remarks:

A small spring under a granite rock, which is in direct contact with the cold water of a small river, that flows into the river Antremabe, tributary of the river Sambirano. We have here 4 m wide canal filled with scree.

Andranomandevy

0021

Location:

East of a mountain called "Bongo d'Andranomandevy" in Firaisampokontany d'Ankoronga. After leaving the village and after having crossed the river Irodo, there is a 3 hours walk, during which one passes the village Anjiamena. When crossing the forest follow the old telephone poles, which used to connect Antsiranana and Vohemar.

Remarks:

A number of springs in the limestone. The most important one, on the highest point forms a little pool, 2 m in diameter and 20 cm deep. A lot of gas bubbles were observed. The water is polluted. The area is surrounded by rich vegetation, especially tamarinds.

Sakaramy

0022

Location:

2 km east of the town Sakaramy. Take the track leading to the dam of the river Sakaramy, it is also a platform. 1 km from this platform there is a farming village, through which lies a path leading to the spring. It is half an hours walk. The spring is at the base of the mountain Zanjiva.

Remarks:

A small spring that forms a pond with marshy growth around. In its middle gas bubbles are observed. Polluted water.

Ampahaka

0023

Location:

On the left side of the road from Ambilobe to Vohémar, 400 m after the milestone 17, follow a clear track that leads to the spring, which is about 300 m from the road. Close to the spring there is a small village called Ampahaka.

Remarks:

The main spring is in the middle of a dense vegetation. The water flows through a canal, 2 m wide, 0,30 m deep and about 700 m long, then it disappears by infiltration into the ground.

Andranomafanakely

0024

Location:

5 km west of Tanambao Manigly. From this village it is possible to continue 3 km more by car, or almost to the village Morafeno, from there is a small path to the spring, which is on the right bank of the river Ambazoana.

Remarks:

There is a stone wall around the spring, which forms a square pool, 4m each side and 1 m deep. A part of the wall is damaged. We are told that it is an old swimming-pool, formerly used to treat the leprous. There is an important upflow of water in the middle of the pool and the water runs off on the other side of the wall and flows into the river Ambazoana.

Andranomafanabe

0025

Location:

1 km upstream the river Andranomafanakely, but on the left bank of the river Ambazoana. It is also west of Tanambao Manigley.

There is also a track from Morafeno, but crossing the river upstream is rather difficult.

Remarks:

The spring is a kind of natural basin, 15 m in diameter, and its walls are of very hard rocks (quartzite). It forms a little pool 5 cm deep with several upflows of warm water. The water flows through a long, 10 m wide canal into the river Ambazoana.

0026

Ranomafana-Est-Tamatave

Location:

2 km SE of the town Ranomafana East. Following the direction Tamatave- Tananarive (R.N. 2), there is a metal bridge before entering the town, 250 m from that bridge on the left river bank there is a small path through a clove plantation. The spring is about 50 m from the confluence of the rivers Santaravina and Andriambola.

Remarks:

The spring is immersed in water. One of the principal upflows is about 20 cm from the bank and 2 others, less important, 2 m further out. The inhabitants have put stones around it to demarkate it. According to information given by the guide this spring shifts from time to time.

Miarinavaratra

0027

Location:

6 km east of the town Miarinavaratra. Accessible by car, but the road is slippery during the rainy-season. The river Ambararata is crossed on a wooden bridge.

Remarks:

Arranged as a swimming pool 4m x 3m. The water is 1,25 m deep. Located between two rice fields. According to information, this water is good for healing rheumatism.

Ranomafana Ifanadiana (Source S1b)

0028

Location:

Spring called no 1 within the ground of the "établissement thermal" de Ranomafana Ifanadiana. This "établissement" is on the PK 404 from the road from Tananrive to Mananjary, on the right side of the river Namorana. The spring is about 50 m from the riverbank at the base of a cliff.

Remarks:

The spring is arranged in a basin 5 x 2 m and 0,50 m high from the ground. The water is 0,75 m deep and there is a number of upflows.

Ranomafana Ifanadiana (Source S1a)

0029

Location:

The water from the spring is collected into the basin S.1a which is in a cabin 2 m further. The water of this spring is for drinking.

Remarks:

The water is shallow and very clear.

Ranofamana Ifanadiana (Source 2a)

0030

Location:

This spring is within the ground of "établissement thermal". It is of same origin as spring S.2b., but it is conducted through a roofed canal 30 x 30 cm.

Remarks:

The water is shallow and disappears after having passed through the canal.

Ranomafana Ifanadiana (Source 2b)

0031

Location:

Spring called no 2 within the ground of the "établissement thermale" It is also called "source du résident Bisson". It is 150 m away from the river Namorana and 100 m from S 1b. Sheltered in a small house.

Remarks:

Very clear water 20 cm (? in original 0,20 cm) deep.

Andranomafana Andonaky

0032

Location:

About 70 km from Fivondronamfrankotany d'Ankazoabo, after having passed the following villages: Tadrano, Angavo, Ambararata Nord, Ambararata Sud, Ankiliofolo and Amina. The following rivers can serve as guiding marks: Rezoky (platform), Mangitraka (platform), Tsiavinandonaka and Mikaiky. The road is accessible by car until a few km from the spring, but it has some very bad parts especially during the rainy-season.

Remarks:

Close to the spring there are huts of "falafa" used by the sick people, who come there for treatment. The spring is also surrounded by varied vegetation, even by palms. There is a sulphuric smell around.

Andranomafana (Amokoty)

0033

Location:

About 4 km east of the village Ambararatabevata at the confluence of the rivers Sakanavaka-Mangoby. Accessible by car, but the river Itakitaky must be forded. The access is very difficult.

Remarks:

The spring emerges in a sandbed and flows into the river Itakiky (? Itakitaky). Shallow.

Miary Ranomafana

0034

Location:

17 km from Firaisamp onkontany de Mahaboboka, after having crossed the river Fiherenana and passed the villages Manera, Soaseranamanera and Tanambao Morofeno. The spring is near the village Miary-Ranomafana. Accessible by car.

Remarks:

According to information given by the inhabitants of Miary-Ranomafana it seems as if the spring emits a thick hot steam in the morning. Its water is shallow and after having flown some meters it flows into a narrow canal.

Ranomafana Andrambo

0035

Location:

20 km from Feraisamp onkontany de Mahaboboka leave the R.N. 7 (national road no 7 from Antananarivo to Toliary) and follow a track, 1 hours walk. The spring is underneath a big tree at the edge of the forest.

Remarks:

Early in the morning the spring has a high temperture and emits a thick steam. The water flows over a calcareous rock into a small river. The place is covered by varied vegetation.

Ranomafana Andravidahy

0036

Location

3 km away from the village Andraviahya, on the right side of the R.N. 7 heading to Tulear. The spring is arranged into partitioned pools like wash-houses. Track not accessible by car.

Remarks:

The water of the spring is shallow, it accumulates in an arranged pool and flows away through a canal.

Ranomafana Tsaripicka

0037

Location:

A 2 hours walk from the village Nosy Ambositra towards Ankazoabo. Cross the river Mangoky and pass the village Tsaripioka. The spring is below a tamarand tree. It has been arranged into a pool from the west and the south side.

Remarks:

There are reed plantations south of the spring. The water is shallow and disappears when crossing a jeeptrack.

Ranomafana Serp

0038

Location:

North of Firaisamponkontany de Bezaha, after having passed the village Dongalaky, on the right side of the river Teheza. The spring is in a small valley and is arranged into pools, which are partly demolished. Accessible by car.

Remarks:

The water of the spring makes a big whirl pool, when coming out and follows a canal for several meters before it disappears in the ground. The drilling pipes, which have been fixed there are made by the "Société de Pétrole de Madagascar".

Ranomafana Devolimanga

0039

Location:

North of Firaisamponkontany de Bezaha, 100 m from a watertower built by JIRAMA. The water comes out of a pipe made by "Société de Pétrole de Madagascar" and flows into a reservoir. The place is accessible by car.

Remarks:

The spring water is used by the inhabitants of Diavolimanga for domestic purposes. The water flows through 2 canals, separated by a hill.

Ranomafana (fiscine)

0040

Location:

South of Firaisamponkontany de Bezaha, in a big lawn. The water of the spring emerges through a pipe, which is shaped like a street fountain. The spring is arranged as a swimming pool. The place is accessible by car.

Remarks:

The water accumulates in the swimming pool, but since there is no drainage system the water is polluted.

Ranomafana Raingile

0041

Location:

The spring is south of Firaisamponkontany de Bezaha in the middle of a reed and sugar-cane plantation. There is a watertower NE of the spring. Accessible by car.

Remarks:

The spring forms a pond and the water flows off through a canal into clumps of reeds.

Ranomafana Ambilanisaba

0042

Location:

South of Firaisampokontany de Bezaha, at the edge of the village Ambilanisaba. The spring is in the middle of a sugar-cane and banana plantation. Accessible by car, but a part of the river Teheza must be crossed.

Remarks:

The water from the spring accumulates on a sand-bank and flows into the river Teheza.

Ranomay (Tongobory)

0043

Location:

4 km from the village Ranomay, following a jeep-track through a forest. The spring is east of the lake Ranomay.

Remarks:

There is a sulphurous smell around the spring. The water accumulates in a pool arranged in steps and it flows into the lake Ranomay. The place is covered with varied vegetation.

Tsiefa Andranomafana

0044

Location:

15 km from Fivondronamapokontany d'Ikalamavony, 2 hours walk (ferry damaged) passing through the villages Alaikofana and Ambodisaka. The spring is 200 m from the right bank of the river Matsiatra.

Remarks:

The spring is shallow. The water flows over a platform of gneissic rocks.

Ranomafana Fitampilo

0045

Location:

15 km from Fivoridronampokontany d'Ikalamavony. 2 hours walk (ferry damaged), passing through the villages Alaikofara and Ambodisaka. The spring is 400 m from the bank of the river Matsiatra, on its right riverside.

Remarks:

The place is covered with vegetation. Shallow spring.

Andranomafana Mohicavina

0046

Location:

15 km away in the direction of Ikalamavony, turn to right at the junction and pass the village Mahazoarivo. The river Matsiatra must be crossed by canoe. The spring is in the Vohidravina valley, surrounded by rice fields.

Remarks:

The cold water from the spring accumulates in a pool arranged by the inhabitants of the village. It flows into the river Matsiatra.

Andranomafana Angaradoa dit Analamaizina

0047

Location:

South-east of Fivondronamfrokontany de Miandrivazo, in the direction to Malaimbandy. Pass the village Amalmaizina and cross a ricefield. The spring is at the foot of a mango tree.

Remarks:

The spring is shallow and muddy, it disappears in the ricefield. It is enclosed by a wood.

Source d'Andranomafananadriana

0048

Location:

Between the milestones 69 and 70, on the R.N. no 4 (Tananarive-Majunga). There is a road sign on the left side indicating the village Sambaina. After Sambaina pass the following villages: Soamahamina, Ambohimanoro- Tsarahonena. This distance, 23 km, is passable by car. The bridges can serve as guiding marks, Andriambe (concrete bridge), Anambana (wooden bridge), Jabo a Tsarahonenana (wooden bridge).

Remarks:

Spring arranged as indoor swimming pool, 10 m long, 4 m wide and 1 m, deep with numerous upflows. It is on the right bank of the river Ikopa at the base of the mountain Andranomafana. There is rich vegetation around. Very popular place.

Source d'Antsira

0049

Location:

Follow the same route as when going to the spring Andranomafanandriana, but at the crossroad before entering the village Tsarahonenana take the turning to the villages Soanierana and Antanetilava. From there go to the south to arrive at the spring Antsira, also known by the name of Anjoinsoka. It can also be reached from the village Miantso.

Remarks:

The water emerges in a reed plantation, it forms a little pool and flows into the river Anjamoka.

Ranomafana d'Anjohibe

0050

Location:

Between the milestones 80 and 81 on the R.N. no 4, take the road to Marondry on the left side, passing through Mangabe and Bemasoandro. From Marondry, which is the last village accessible by car, there is a 4 hours walk to west passing through the following villages: Keliakoho, Antsampan-rano, Mariarano, Miarianrivo, Maharidaza, Ambosary, Andranofotsy and Ambonierana.

Remarks:

On an islet in the river Malailay. Passable on foot, as the shallow water of the river forms a waterfall on very hard rocks. The spring is arranged as a square well, 4 m each side and 2 m deep, with stone steps into it. The walls of the pool are of stone, piled up without cement. There is rich vegetation around, predominantly mango shoots.

Ranomafana de Sahalolo

0051

Location:

It is in the same direction as the Anjohibe spring (0050), until the village Marondry. From there it is to SW passing through the following villages: Tsarahonenana, Masindray, Mahafaly, Filalaoavana. It is a 3 hours walk to the spring, which is on the right bank of the river Ikopa at the base of a high hill called Ankadivato.

Remarks:

The spring is like a circular pool, 4m in diameter, surrounded by reed plantation. Its water is very clear, 0.70 m deep, and flows through a canal into the river Ikopa. There are two main springs in the middle of the pool.

Mahatsinjs Ambohipano

0052

Location:

Ten years ago the spring was named Mahatsinjofruisque, after the main neighbouring village. Today the inhabitants know it better by the name of "the spring of Ambahipano". It is about 10 km NE of Analavory.

It is possible to drive to the village Mhatsinjo during the dry season. From there it is a 2 hours walk passing the following villages: Ambatolampy, Ampalumanga and Ambohipano.

Remarks:

The water comes from underneath a pile of hard rocks, especially gneiss. There is a rich gas discharge.

Ranomafana Anosibe

0053

Location:

In the marsh of Ifanja, now used as rice fields and cultivated land, 800 m east of the village Anosibe in fonkontany d'Ampokonato. During the dry season it is possible to drive to Betongolo, passing through the following villages after Analavory: Bengetrika, Ngiliomby, Ambokibary.

Remarks:

The water forms a circular pool, 10 m in diameter. The main spring is at its easternmost side. It is surrounded by reeds and other vegetation.

Ramainandro

0054

Location:

On the route to Faratsiho-Manalolondo Arivonimana. 3 km NE of Firaisamponkontany de Ramainandro, there is a road to right, which leads to the spring, before the second wooden bridge.

Remarks:

A 1,5 m high circular stone wall with a gate surrounds an area of 20 meters in diameter. In the center of this area is a hut 3 m each side, sheltering the well. The well is 1 meter square filled with water from the spring. The water flows off through a pipe.

Henikenina Quest

0055

Location:

After the milestone 214 on the R.N. no 7 (Tananarive -Tuléar), there is a turning to the right, which leads to the spring. The track, accessible by car during the dry season, is about 26 km. It passes by the factory SOMADDEX and the village Fierenantsoa.

Remarks:

The spring is on the slope of a mountain, in a deep excavation. The water emerges in a fine and clayish sandlayer, forms a small pool, 2 m in diameter and 1 m deep, flows off as a creek. There are three main upflows.

Henikenina Est

0056

Location:

It is the same track as to the spring Henikenina West, but this one is at the base of another mountain 1 km away from Henikenina West.

Remarks:

The spring, which lies higher than the big ricefield, forms a pool, 15 m in diameter. There are 3 main upflows in the middle. Wild cress grows around.

0057

Andranonafana Vohidambo

Location:

1 1/2 hours walk west of Firaisanpokontany Ilaka - Center, passing the village Mahazina- Ambohiperenena. It is about 15 m north of the bank of the river Vohidambo, overlooked by the mountains Andranombovahana, Ampandirambositr and Antampon Ilaka.

Remarks:

The place is arranged as an accumulation basin. The spring is shallow and its water flows into the river Vohidambo through a narrow canal.

0058

Ranomafana Tsangandrano

Location:

2 km west of the village Tsangandrano, the chief village of Fokontany, 40 km NE of Ambatofi. Accessible by car during the dry season.

Remarks:

The main spring is between 3 granite blocks and emerges from coarse grained sand. The water forms a big pool, more than 20 m in diameter, 0,25 m deep, with a layer of rounded pebbles on its bottom. It forms after that a small river named Ranomafana, which is tributary to the river Mania. There is steam discharge in a number of places.

Ranomafana Ampasimihebo

0059

Location:

From the village Tsangandrano take the direction NW towards the village Kianja, cross the river Mania and pass the village Kianjaraloha. It is a 4 hours walk. This spring is in the Betafo region.

Remarks:

The spring forms a little pool, which extends into a canal surrounded by marshland vegetation. The water is appreciated by cattle.

Ranomafana Kelipetaka

0060

Location:

4 km west of the village Tsangandrano, in a valley basin covered with forest. Cross the river Ranomafana, go around a hill.

Remarks:

The water emerges from beneath a vertical rock wall and forms a creek. Coarse sand and rock particles are constantly stirred up at the water exit.

Ranomafana d'Antsira

0061

Location:

7 km north of Trinjorano. This village is accessible by car during the dry season. From there it is a 2 hours walk to the spring.

Remarks:

In a valley covered by marshland vegetation. The spring forms a little pool, 1 m in diameter, 0.20 m deep. The water is polluted.

Ranomafana Laondany

0062

Location:

Ten km NW of Tsangandrano, in the Laondany valley. Cross the river Mania at the village Ampano.

Remarks:

The water emerges in the middle of a scree and from beneath a thick sandlayer. It forms a creek, which flows into the river Mania.

Ranomafana Langainony

0063

Location:

In the Sahamadio valley. South of the village Langainony, on the left bank of Matsiatra.

Remarks:

The spring is surrounded by reed and marshland plants. It forms a little pool, 2 m in diameter and 0,20 m deep, flows off as a creek for some distance.

Ranomafana Sahavatoana

0064

Location:

18 km NW of Ambatofinandrahana. You can drive to the spring by passing the "station thermale" of Ranomafana d'Ambatofinandrahana.

Remarks:

In a marsh covered by reed. The spring forms a pool, 2 m in diameter and 0,50 m deep. There is a sulphurous smell.

Ranomafana Imody

0065

Location:

In the Firaisana de Fenoarivo. You can drive from Fenoarivo to Marotatatra. From there it is a 3 hours walk. The spring is at the base of the hill Lalavana on the right bank of the river Matsiatra, 25 m from a big waterfall.

Remarks:

The spring emerges in granite. Arranged as swimming pool and it flows into Matsiatra. The place is covered by high trees.

Ambohibato

0066

Location:

About 10 km SSE of Ambatofinandrahana. Close to the village Ambohibato.

Remarks:

A small spring in a marsh, surrounded by reeds. It forms a little pool, 1 m in diameter and 0,15 m deep.

Mahaso

0067

Location:

About 30 km NNW of Amboranpotsy and one km north of Maharoa.

Remarks:

Emerges in a valley

0068

Mafana

Location:

The village Mafana is 32 km north of Janjina. The river Manambolo passes 500 m from Mafana. The spring is in the bed of that river, close to the left bank.

Remarks:

The water emerges from coarse sand layer immersed in water from the river. There is a number of springs within a radius of 8 m.

Antsirasira

0069

Location:

Two hours walk north of the village Mafana.

Remarks:

The spring is in a rock pile. It forms a small creek 0,10 m deep.

Ambia-Quest

0070

Location:

About 10 km north of Malaimbandy. The village Analafaly is accessible by car, from there it is a 3 hours walk.

Remarks:

The spring is covered by a thick sandlayer on an area of 20 m². The inhabitants have dug holes in the sand, through which the water emerges.

Ambia-Sud-Est

0071

Location:

About 10 km NE of Malaimbandy, passing the village Ambia.

Remarks:

The spring is arranged as a small pond, 1,50 in diameter and 0,50 m deep. There is a sulphurous smell.

Antsira

0072

Location:

About 30 km south of Malaimbandy. Passable by car until Mahavano. From there it is an hour's walk to the SW.

Remarks:

The water emerges from fissures in sandstone and schist. There is steam discharge in several places and salt deposits.

Kiposa

0073

Location:

About 20 km SE of Malaimbandy. Accessible by car to Mahatsinjo. It is a 3 hours walk from there to the spring in eastern direction.

Remarks:

In a valley bottom covered by forest. The water emerges from fissures in sandstone. There are salt deposits and pebbles lying around.

Ranomafana de Bevoho on Ansrotsy

0074

Location:

25 km south of Ankilizato passing the villages Tanandaka and Morarano.

Remarks:

On the bank of the river Antrosy. Surrounded by marshland plantations. Arranged for bathing. It is a popular place.

Vongoho

0075

Location:

About 30 km SE of Ankilizato.

Remarks:

The spring emerges from a sand layer, between rocks that have fallen down. It forms a creek, which flows into the river Vongoho.

Analabe

0076

Location:

About 20 km NE of Miandrivazo.

Remarks:

The spring forms a pool, 1 m in diameter, shallow, surrounded by marshland vegetation.

Andranomandevy

0077

Location:

The bridge Anraketa P.K. on Firaisana de Malaibandy. Junction through the villages Andraketa, Ankilmihohoka, Ampasifany, Namhore, Sakoazato, Andranomandevy. One hour's walk east of Andranomandevy.

Remarks:

In the middle of the sand deposits of the river Andranomafana. Surrounded by wild plants, orange trees and others.

Amerobe

0078

Location:

35 km north of Miandrivazo, on the road to Ankavandra. East of the village Manandaza.

Remarks:

Ranomafana Marantsandry

0079

Location:

26 km west of Fivondrorampokontany of Fénériver - East, after 1 1/2 hours canoeing on Maningory, passing the villages Mangondreno, Mahasoia and Ambodibonara. The spring is near the village Ambodivotra on the left bank of the river Maningory, about 30 m from the river bank.

Remarks:

The water of the spring comes out of a hole, 0,40 m in diameter and 0,30 m deep. It flows into the river Maningory through a narrow canal. The place is covered by clove and banana plantations and other vegetation. The water is sulphurous.

Ranomafana Vohitsara

0080

Location:

2 hours walk on the road to Soanierana-Ivongo. The spring is 1 km from the village Rantolava on the left bank of the river Sahatsara, which is tributary to Maningory.

Remarks:

Shallow spring, forms a pool, 1 m in diameter and 0,20 m deep. It disappears in the bushes. The place is covered with varied vegetation.

Ranomafana Ambilanifotsialana

0081

Location:

36 km on the road to Soanierana Ivorigo, before taking the ferry at Anjahambe, passing through the villages Ampasimbe, Marovovona, Vohimafaitra and Sangnindonana. The spring is north of the village Antsiatsiaka.

Remarks:

Shallow spring, surrounded by clove plantations, flows off as a creek.

Ranomafana Vohibato

0082

Location:

4 km away from the spring Ambilanifotsialana, south of the village Antsiatsiaka. The spring is at the edge of a forest.

Remarks:

A rather shallow spring, covered by eucalyptus and other vegetation. Its water disappears into the bushes through a narrow canal.

Ranomafana Doany

0083

Location:

2 km east of Firaisampokontany Doany, after crossing the river Androranga. The spring is about 20 m from the river, on the right river bank.

Remarks:

The water of the spring flows into 2 basins and a log cabin with 3 bathtubs. Sulphurous water.

Androranga

0084

Location:

4 hours walk east of Firaisampokontany Doany. The spring is on the left bank of the river Anjialava-Bemarivo, 200 m from the river.

Remarks:

The spring forms a pool, 1 m in diameter and 0,10 m deep. It flows through a narrow canal into Anjialava-Bemarivo. Sulphurous water.

Andranomlolo

0085

Location:

2 km west of Andranomafanahely-Doany. The spring is 1 km away from the village Andranomololo, 10 m from the river Androranga, on its right river bank.

Remarks:

A shallow spring surrounded by varied vegetation. It flows into the river Androranga through a narrow canal. The place is surrounded by high peaks.

Andranomafanahely-Doany

0086

Location:

West of Firaisampokontany Doany, passing the villages Antsahamena, Befamatra and Ankevaheva and crossing Antrahabe, a right tributary of Androranga. The spring is about 30 m from the right river bank of Androranga.

Remarks:

Polluted water. The spring is surrounded by big bushes, The spring is in a canal, 30 m long and 1 m deep, which flows into the river Androranga.

Ankiakabe

0087

Location:

6 hours walk north of Ranomafana passing the villages Ambodivoany, Ambodizany, Antavambao and Angarongameloka. The spring is 1 km from the village Ankiakabe.

Remarks:

The place is surrounded by rice, coffee plant and vanilla tree plantations. The water emerges from a sand bank and disappears in the forest.

Ranomafana Andranomadio

0088

Location:

6 hours walk north of the village Anjialavabe. The spring is in a forest.

Remarks:

Shallow spring. The water accumulates underneath a tree trunk and disappears in the bushes, through some meters long but narrow canal.

Ranomafana d'Ambodiangezaka

0089

Location:

West of Firaisampokontany Anoviara, passing through the villages Ambalambato, Maroambihy and Ambodivohitra. The spring is about 1 hour's walk from Firaisampokontany Antrahamena, in the middle of a forest.

Remarks:

The spring forms a pool, 1 m in diameter and 0,50 m deep. It flows into the bushes. The water is sulphurous.

Ranomafana d'Andramonta

0090

Location:

NW of Fivondronampokontany Andapa and 30 km from Ambodiangezoka. The spring is in the middle of a very dense forest.

Remarks:

The spring emerges from the foot of a tree, it accumulates in a sandbank and disappears in the tracks.

Ranomafana de Marolakana

0091

Location:

West of Fokontany Ampotsilay, pass the villages Antsirabe and Marolakana, cross the river Marolkana 3 times. It is a 5 hours walk to the spring

Remarks:

The spring is partly arranged. There are 2 accumulation basins, made of girders and planks. The spring is rather deep and its water flows into the bushes. A rather high hill rises above.

Ranomafana Antsasaka

0092

Location:

Same localisation as for no 91, but this one is further north.

Remarks:

The water accumulates in a small pool surrounded by blocks of stone. It flows into a small river, which flows into the river Marolakana through a narrow canal. The place is covered by vegetation.

Soatanimbary

0093

Location:

About 10 km east of the village Soatanimbary in Firaisampokontany d'Ambatolahy. Soatanimbary is accessible by car, but from there it is a 2 hours walk to the spring.

Remarks:

The spring is in the middle of a fine sandlayer. It forms a pool, 2 m in diameter and 0,50 m deep. The water flows through a small canal into a cold river.

Mahobo

0094

Location:

About 10 km from the town Mahabo. Following the direction Mahabo - Ankilizato, the spring is close to the road, on its right side.

Remarks:

The spring is arranged as a well, cemented and with pipes. There is a sulphurous smell in the morning.

0095

Soatanana

Location:

About 20 km NW of Mandabe. Follow the road Mandabe - Mahabo and after the village Antsakamahabe, turn to left towards the village Soatanana. The spring is 1 km east of this village.

Remarks:

The spring is in a thick sandlayer, on the edge of a reed plantation. Arranged as a well, 4 m each side and 0,50 m deep.

Ambango

0096

Location:

About 30 km WNW of Mandabe. When following the road Mandabe - Mahabo, take a track to left towards the village Ambango 2 km before the village Ankilimbazaha. The spring is in the neighbourhood of this village, on the right bank of the river Maharivo.

Remarks:

The spring is arranged in a number of square basins. After that the water flows into a small canal. There is a sulphurous smell.

Emitray

0097

Location:

5 km west of Esira in the valley of the Janakatra. river. The spring is known by the name Vohiposa after the village nearby.

Remarks:

The spring is in the sand on the riverbank. It is submerged during the rainy season.

Betaimboraka

0098

Location:

About 10 km SW of the town Ranomafana or about 50 km ESW of Mananteniria. (ESW in original).

Remarks:

In the valley of Mandrare and Maroamalo. 3 km from their confluence. The water emerges from granite submerged in the riverbed.

Marosanoa

0099

Location:

2 km south of the village Ranomafana de Fort-Dauphin.

Remarks:

The spring is on a hillock, surrounded by the river Andramanakana. Arranged as a swimming-pool 4 m x 3 m, 0,50 m deep. The water is conducted to the pool by a pipeline of cast-iron.

Sarongaha

0100

Location:

About 30 km south of Manantenina in the Manampanihy valley.

Remarks:

The spring is in a sandlayer between granite blocks. The water forms a small creek, when flowing away. There is a sulphurous smell around.

Folakara

0101

Location:

In the neighbourhood of a former "project" of the Société d'Exploitation et de recherches pétroliers (SERP). There is a number of springs. Our sample is from the biggest.

Remarks:

The spring emerges from fissures in bituminous rocks and accumulates in a hole in the rock a little bit further down.

Antanandava

0102

Location:

About 15 km NW of Marafenobe in the Antanandava tectonic valley.

Remarks:

The spring is in a sandbank of a river and its water mixes with that of a small river. It forms a small pool, 20 cm in diameter and 10 cm deep, which forms a creek when flowing off.

Berohay

0103

Location:

16 km SW of Morafenobe, on the road Andranomorery - Mainirano, 2 km from the village Berohay.

Remarks:

The water is sulphurous. In the middle of a reed plantation. Forms a small pool, 15 cm in diameter and 0,10 cm deep, forms a creek, which flows into the river Berohay.

Ampoza Bebai

0104

Location:

About 20 km NE of Tambohorano in the Feraisampokontany of Bebao Ranobe.

Remarks:

Thermal spring arranged as swimming-pool - bathtubs. Very popular place.

Ankilimahasoa

0105

Location:

SW of Antsalova on the road to Masoarivo. Junction from Saririaky and Ankilimatrasoa is 7 km from Saririaky.

Remarks:

Big circular pool, 5 m in diameter, 2 m deep. Sulphurous smell.

Benmonto

0106

Location:

The village Bemonto, the last village before Ansahalova, is on the right hand on the road from Maintirano to Antsalova. From Bemonto it is a 2 hours walk to Ambalasakoa and the spring is about 1 km east of this village.

Remarks:

The spring is in a reed plantation. Forms a small pool, 20 cm in diameter and 10 cm deep.

Tabalahely (Nosy Be)

0107

Location:

12 km north of the town Nosy-Be. The spring is in the middle of a Kalasia forest. Accessible by car.

Remarks:

The spring is arranged as "vovo", 1 m in diameter. It is a sacred place.

Tabalahoriko (Nosy Be)

0108

Location:

15 km from the town Nosy-Be, SW of the spring Tabalahely. The spring is on the western side of the road Ibell-Ville - Bzamazai, about 800 m south of the village Androkaroka, in the bed of the river Tablahonko.

Remarks:

trees named "honko" are all around the spring, which is 0,25 m in diameter and 0,40 m deep.

Bejofo

0109

Location:

About 3 km NE of the village Ambatomarity, on the left bank of the river Andranomalga, which must be crossed 5 times. The spring is about a day's walk from Maromandia.

Remarks:

The place is covered by varied vegetation. The spring is shallow, its water accumulates in a small pool and flows through some meters long, but narrow canal into the bushes.

Sahasarotra

0110

Location:

In the valley of the river Sahasarotra, about 8 km or 2 hours walk SE of Miandrarivo.

Remarks:

The spring is in the limestone, arranged in a small pool by the inhabitants. It is surrounded by rocks, especially gneiss.

Antsirabe (Source froide)

0111

Location:

Inside the parc, SW of the hospital.

Remarks:

The water is for drinking.

Antsirabe (eu domestique)

0112

Location:

Water sample taken in a house close to the railway - station.

Malailay

0113

Location:

13 km NNW of Fivondroramponkontany, passing the village Amboni-vondrana and crossing the river Kalobevana. From the village Matavia-koha it is a 1 1/2 hours walk to the spring, which is some meters from the right river bank.

Remarks:

The spring is in a middle of a forest. Its water accumulates in a small pool, surrounded by quartzite blocks, and flows through a narrow canal into the river Malailay.

Malailay

0114

Location:

Same location as for no 0113, but this one is 4 m further north.

Remarks:

Spring surrounded by quartzite blocks. The water emerges from a rock at the foot of a mango-tree. It flows into the river Malailay through some meters long, but narrow canal.

Ranomafanai Ankohabe

0115

Location:

NE of the village Ankotrabe. The spring is 1 km from the village Autrira (?), on the road to Fenoarivo-Center.

Remarks:

Shallow spring, which accumulates in a small basin, filled with alluvium and flows into the river Autrira, through a canal, which is beside a low hill of volcanic blocs.

Ranomafana d'Andasibe

0116

Location:

About 15 km south of Andasibe in the valley of Antsahanavoney, which separates Fivondronampokontany de Kandreho and Fenoarivo-Center. It is a two hours walk from Antsahanavony to north.

Remarks:

On the bank of the river named Ranomafana. Arranged as baths, dug into the sand and surrounded by stone walls. There is a sulphurous smell.

Source de Sainte-Marie

0117

Location:

In the cashew-tree plantation of St-Marie, which is 28 km SE of Amboromalandy, 2 km east of the water and forest station called Ambohimahabibo.

Remarks:

Source emerges from calcareous sandstone, in the middle of a forest.

Appendix 1.6 Estimated flow rate of springs

APPENDIX 1.6 ESTIMATED FLOW RATE OF SPRINGS

<u>Sample</u>	<u>1/sec estimated flow rate</u>	<u>Sample</u>	<u>1/sec estimated flow rate</u>
790001	0.7	790021	0.5
790002	1.0-1.5	790022	0.1
790003	2	790023	1.5
790004	1.5	790024	2
790005	0.4	790025	2.5
790006	0.3-0.4	790026	4
790007	3.5-4.5	790027	2
790008	3	790028	4
790009	3	790029	1
790010	10	790030	0.1
790011		790031	2
790012	3	800032	20
790013	0.3	800033	
790014	4	800034	0.5
790015		800035	0.5
790016	3-4	800036	2
790017	3	800037	10
790018	0.5	800038	20
790019	1	800039	
790020	0.1	800040	30

APPENDIX 1.6 ESTIMATED FLOW RATE OF SPRINGS (Continued)

Sample	1/sec estimated flow rate	Sample	1/sec estimated flow rate
800041	2	800061	2
800042	1	800062	2
800043	20	800063	2
800044	0.5	800064	1.5
800045	2	800065	3
800046	1	800066	1
800047	1	800067	0.5
800048	3	800068	1
800049	1	800069	1
800050	2	800070	3
800051	2	800071	1
800052	2	800072	2.5
800053	5	800073	2
800054	2	800074	2
800055	2	800075	2
800056	1.5	800076	1
800057	4	800077	2
800058	10	800078	1
800059	2	800079	10
800060	3	800080	1

APPENDIX 1.6

ESTIMATED FLOW RATE OF SPRINGS

(Continued)

<u>Sample</u>	<u>l/sec estimated flow rate</u>	<u>Sample</u>	<u>l/sec estimated flow rate</u>
800081	0.5	8000101	1
800082	1	8000102	1
800083	5	8000103	1
800084	10	8000104	2
800085	0.5	8000105	8
800086	3	8000106	1
800087	1	8000107	1
800088	0.5	8000108	10
800089	10	8000109	2
800090	0.5	8000110	1
800091	10	8000111	0.5
800092	2	8000112	
800093	2	8000113	10
800094	8	8000114	0.5
800095	1	8000115	1
800096	2	8000116	1
800097	1	8000117	10
800098	2		
800099	3		
800100	1		

Appendix 1.7 Geological time scale.

Geologic column and time scale

<i>Era</i>	<i>System or Period (rocks) (time)</i>	<i>Series or Epoch (rocks) (time)</i>	<i>Approximate age in millions of years (beginning of unit)</i>
<i>Cenozoic (recent life)</i>	Quaternary (an addition to the old tripartite 18th-century classification)	Holocene	.01
		Pleistocene (most recent)	2.0 to 3.0
	Tertiary (Third, from the 18th-century classification)	Pliocene (very recent)	7
		Miocene (moderately recent)	25
		Oligocene (slightly recent)	40
		Eocene (dawn of the recent)	60
		Paleocene (early dawn of the recent)	68 to 70
<i>Mesozoic (intermediate life)</i>	Cretaceous	135	
	Jurassic	180	
	Triassic	225	
	Permian	270	
<i>Paleozoic (ancient life)</i>	Carboniferous		
	Pennsylvanian	325	
	Mississippian	350	
	Devonian	400	
	Silurian	440	
	Ordovician	500	
<i>Precambrian</i>	Cambrian	550 to 600	
	Many local systems and series are recognized, but no well-established worldwide classification has yet been delineated.	3500 or more	

(Kumme1, 1970)

Appendix 2. Guide to the technique of collecting thermal water, the treatment of samples and analytical procedure of field analysis.

List of Content

1. Recording of samples.
2. Collection technique .
3. Treatment of samples.
4. Analytical procedure of selected elements.
 - 4.1 Determination of pH and CO₂.
 - 4.2 Determination of H₂S.

1. Recording of Samples.

One of the most important thing during collection of water samples is good recording. Analysis of water after careful collection procedure is of little use if noone knows where the samples were taken.

For the purpose of keeping good record of samles, we supply special form. The upper part is for general information, such as number of sample, date of collection, the location of sample, reference to geographical map, and brief description of geological features. The temperature of the spring, and estimated or measured flow rate is also recorded. The lower part of the form is for recording all analytical measurements done during or shortly after collection. This part is used in connection to part 4 of this manual.

2. Collection Technique.

For the collection of thermal water from hot springs and drillholes with temperature lower than 100°C the following are required:

1. Polythene tubing 1/4", 5 m long.
2. Polythene can, 0.5 - 1.0 liters.
3. Polythene funnel.
4. Maximum thermometer.
5. Stainless steel cooling spiral to fit 1/4" tubing.
6. Bucket (10 liters).
7. Gas sampling bulb (250 ml).
8. Polythene bottles for storing the samples.

Various techniques have been developed to collect water from thermal springs, in order to minimize contamination from soil and rocks. Spring with high flow rates and/or wide basins are most easily sampled by scooping up the water with the can. If there is some slope where the water can flow, it is most convenient to use the funnel and the tubing (see lower part of fig. 1 and 2). In some cases, if

the pooles are only a few centimeters deep the water can be sucked up using the gas sampling bulb.

The cooling spiral is only necessary for that part of the sample which is stored in the gas sampling bulb, later used for determination of pH, CO_2 , and H_2S (see fig. 2). The cooling spiral is made of stainless steel, but cooling spirals made of copper have been used. The latter is not suitable because the copper reacts with the hydrogen sulphide giving low concentration for sulphide during determination. It is desirable to cool the sample down to the storage temperature, where the analysis are done. If the sample is not cooled before it is stored in the gas sampling bulb, volume reduction caused by later cooling will produce low pressure in the bulb and cause degassing. During collection the temperature is measured using maximum thermometer and the water flow is measured or estimated.

3. Treatment of Samples.

It must be guaranteed during collection of samples, that the concentration of the elements does not change until the analyses are carried out. The following components often changes during storage: pH, carbonate, hydrogen sulphide, calcium, magnesium, sulphate, nitrate and silica. This can be prevented in the following way:

1. Carbonate, sulphide and pH.

Carbonate and sulphide degasses during storage and change the pH. To prevent this, part of the sample is cooled and stored in the gas sampling bulb. This is determined within 36 hours, usually the same evening.

2. Sulphate.

If the concentration of the hydrogen sulphide is high, the sulphide can oxidize to sulphate. To be able to determine sulphate after storage, the sulphide must be precipitated using $\text{Zn}(\text{CH}_3\text{COO})_2$ solution (20.88 g/l). Two ml of the solution is added to 100 ml of the sample and stored in polythene bottle.

3. Calcium and nitrate.

Ammonium and nitrite may oxidize to nitrate during storage. Oxidation may be prevented by freezing the sample. Calcium and magnesium sometimes precipitates from the water during storage, specially if the carbonate content is high. To prevent this, part of the sample is acidified. One ml conc. HCl is added to 100 ml of sample and then stored in polythene bottle.

4. Silica.

If the silica content is above 100 ppm, it will polimerize. This can be prevented by dilution of the sample if the silica content is expected to be higher than 100 ppm, which simplifies analysis. For the time being this will be left in the Madagascar case, because the polymerized silica can be disintergrated by boiling in dilute alkaline solution.

The concentration of other major components are not expected to change during storage. For determination of these elements, 500 ml of sample is stored in a polythene bottle.

Summary of Collection:

1. One gas sampling bulb, cooled to 20-30 °C.
2. 500 ml sample untreated, in polythene bottle.
3. 100 ml sample + 1 ml conc. HCl to polythene bottle.
4. 100 ml sample + 2 ml $Zn(CH_3COO)_2$ to polythene bottle.

4. Analytical Procedure for Selected Elements.

In this guide, only the procedure for analytical technique of the elements determined in the field will be given. These are pH, CO_2 , and H_2S . The lower part of the record form shall be used for all analytical information.

4.1. Determination of pH and carbonate.

Total carbonate is determined by titration with 0.1 N HCl from pH 8.2 to 3.8 at 20°C but pH is measured using pH meter.

The following equipment and reagents are required for this determination:

- 1) portable pH-meter
- 2) pH electrode
- 3) saturated KCl solution
- 4) three small beakers for pH buffers
- 5) 150 ml beaker for sample
- 6) 50 ml and 100 ml volumetric flasks
- 7) thermometer
- 8) 25 ml burette calibrated at 0.1 ml interval, burette stand and clamp or 2.5 ml micro syringe
- 9) 1 ml and 5 ml pipettes
- 10) 0.1 N HCl solution (e.g. titrisol 0.1 N HCl, Merck 9973)
- 11) Approx. 0.1 N NaOH solution. Dissolve 4 g NaOH in 1 liter of distilled water
- 12) pH buffers. Phosphate buffer 6.88, borax buffer 9.22 and acetate buffer 4.62
- 13) distilled water

Procedure:

- 1) Fill the electrode with KCl solution if necessary.
- 2) Rinse the electrode with distilled water.
- 3) Adjust the pH-meter to the 6.88 pH-buffer.
- 4) Measure the 9.22 and 4.62 buffers and rinse the electrode between measurements with distilled water.
- 5) Measure 100 ml (50 ml) of sample using the volumetric flask. and put into the 150 ml beaker.
- 6) Determine the pH and the temperature.
- 7) Adjust the pH carefully to correct 8.2 value using 0.1 N HCl if the pH is higher than 8.2 but using 0.1 N NaOH if the pH is lower than 8.2.
- 8) Titrate from pH 8.2 to pH 3.8 using 0.1 N HCl.

- 9) Record the amount HCl required.
- 10) Rinse the electrode with distilled water and go to no. 5. Titrate each sample in duplicate.
- 13) $\text{ppm CO}_2 = \left(\frac{\text{ml HCl} \cdot N \cdot 44000}{\text{ml sample}} \right) - (6.93 + 1.182 \text{ ppm H}_2\text{S} + 0.0088 \text{ ppm Si O}_2)$

The procedure in part 1 - 4 are only made once every time measurements are carried out and are valid for all samples measured at the same time. The measurement of three pH buffers makes it possible to correct for deviation from theoretical behaviour of the electrode. Two methods can be used for these corrections. One involves plotting measured values of the pH-buffers against right values of the buffers and then use the best fit line for correcting the pH of the samples. The other method is to use two buffers (6.88 and 9.22) and calculate correct pH using:

$$\text{pH sample}_{\text{corr.}} = 6.88 + \frac{(9.22 - 6.88)}{\text{buffer } 9.22_{\text{meas.}} - 6.88} (\text{pH sample}_{\text{meas.}} - 6.88)$$

The values of the pH-buffers varies with temperature. The values 4.62, 6.88 and 9.22 are at 20°C. If the temperature is different the values have to be corrected according to table 1.

TABLE 1.

Changes in pH values of buffers with different temperature.

°C	Phosphate Buffer	Borax Buffer
0	6.984	9.464
5	6.951	9.395
10	6.923	9.332
15	6.900	9.276
20	6.881	9.225
25	6.865	9.180
30	6.853	9.139
35	6.844	9.102
38	6.840	9.081
40	6.838	9.068
45	6.834	9.038
50	6.833	9.011

°C	Phosphate Buffer	Borax Buffer
55	6.834	8.985
60	6.836	8.962
70	6.845	8.921
80	6.859	8.885
90	6.877	8.850
95	6.886	8.833

If the electrode is far off right values for the buffers, the starting and the end point of the titration must be corrected. The new values can be calculated using the same equation as for pH correction. In table 2 the starting and end points have been calculated for few values of the pH buffer 9.22.

TABLE 2

Values of starting and end point for CO₂ titration. The pH meter is adjusted to the 6.88 buffer, and the buffer 9.22 is measured.

- I. Measured value of buffer 9.22 .
 II. pH at the starting of CO₂ titration.
 III. pH at the end of CO₂ titration.

<u>I</u>	<u>II</u>	<u>III</u>	<u>I</u>	<u>II</u>	<u>III</u>
8.7	7.91	4.48	9.24	8.21	3.77
8.75	7.93	4.42	9.26	8.22	3.75
8.80	7.96	4.35	9.28	8.23	3.72
8.85	7.99	4.29	9.30	8.25	3.69
8.90	8.01	4.22	9.32	8.26	3.67
8.95	8.04	4.16	9.34	8.27	3.64
9.00	8.08	4.09	9.36	8.28	3.62
9.02	8.09	4.06	9.38	8.29	3.59
9.04	8.10	4.04	9.40	8.30	3.56
9.06	8.11	4.01	9.50	8.36	3.43
9.08	8.12	3.98	9.55	8.39	3.37
9.10	8.13	3.96	9.60	8.41	3.30
9.12	8.14	3.93	9.70	8.47	3.17
9.14	8.15	3.91	9.80	8.53	3.04
9.16	8.17	3.88	9.90	8.58	2.90
9.18	8.18	3.85	10.00	8.64	2.77
9.20	8.19	3.83			
9.22	8.20	3.80			

4.2 Determination of H₂S

Hydrogen sulphide is determined by titration with Hg(CH₃COO)₂ solution.

Equipment and reagents necessary for the field measurement of hydrogen sulphide are:

- 1) 10 ml burette calibrated at 0.05 ml intervals, burette stand and clamp or 1 ml micro syringe.
- 2) 50 ml Erlenmayer flask.
- 3) 1.0 ml, 5.0 ml and 10 ml pipettes.
- 4) 5.0 ml or 10 ml measuring cylinder.
- 5) Glass rod
- 6) Acetone
- 7) 5 N NaOH solution. Dissolve 200 g NaOH in 1 liter distilled water.
- 8) Solid dithizone.
- 9) 0.001 M Hg(CH₃COO)₂ solution freshly prepared. Dissolve 0.3187 g Hg(CH₃COO)₂ in 1 liter distilled water.

Procedure:

- 1) Measure 5 ml 5N NaOH and 5 ml acetone into 50 ml Erlenmayer flask.
- 2) Add 1.0 - 10 ml of sample and distilled water to the flask. The amount of sample depends on the H₂S concentration. The total amount sample + distilled water should be 10 ml.
- 3) Add small grain of solid dithizone.
- 4) Titrate with 0.001 M Hg(CH₃COO)₂ to red endpoint.
- 5) Record volume of sample and amount of Hg(CH₃COO)₂ needed.

$$6) \text{ ppm H}_2\text{S} = \frac{\text{ml Hg(CH}_3\text{COO)}_2 \cdot 34}{\text{ml sample}}$$

During the titration, black precipitate of HgS forms. The end point is decided when the colour changes from yellow

colour of the dithizone in alkaline solution to the red colour of the Hg-dithizonate. If the concentration of H_2S is high the sample becomes yellowish brown and even black during titration. This is caused by the HgS precipitate and makes the endpoint uncertain. In the case of high concentration of H_2S it is better to reduce the volume of the sample.

Figure 1

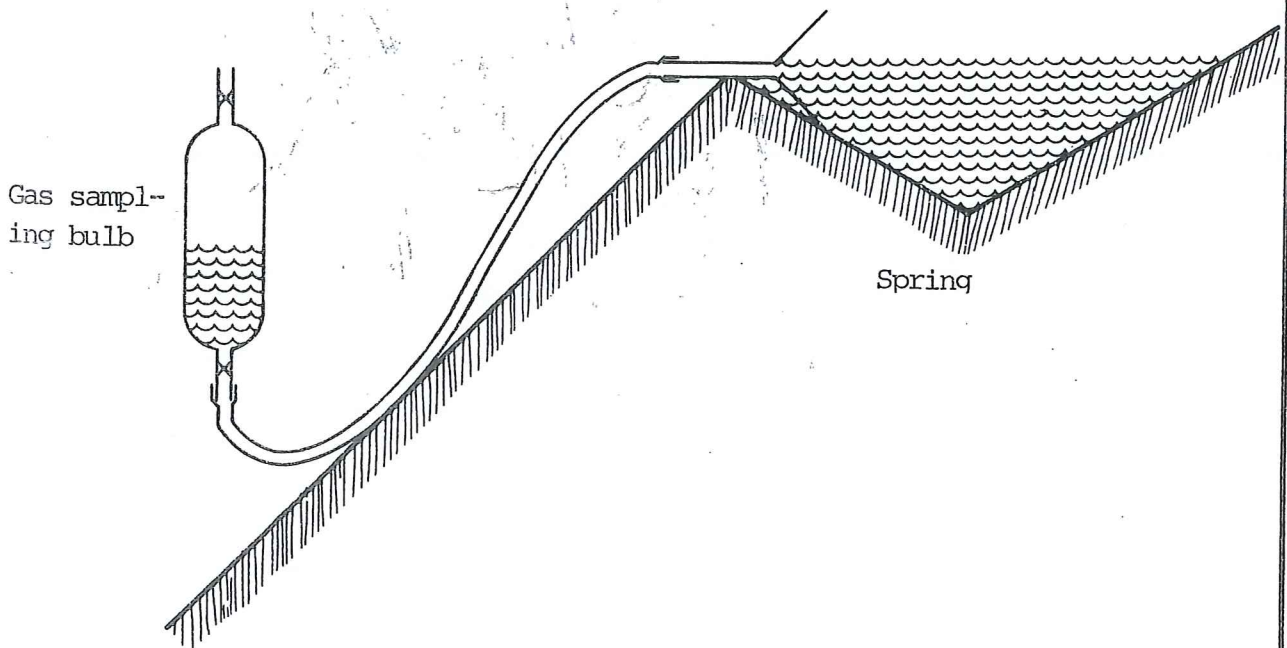
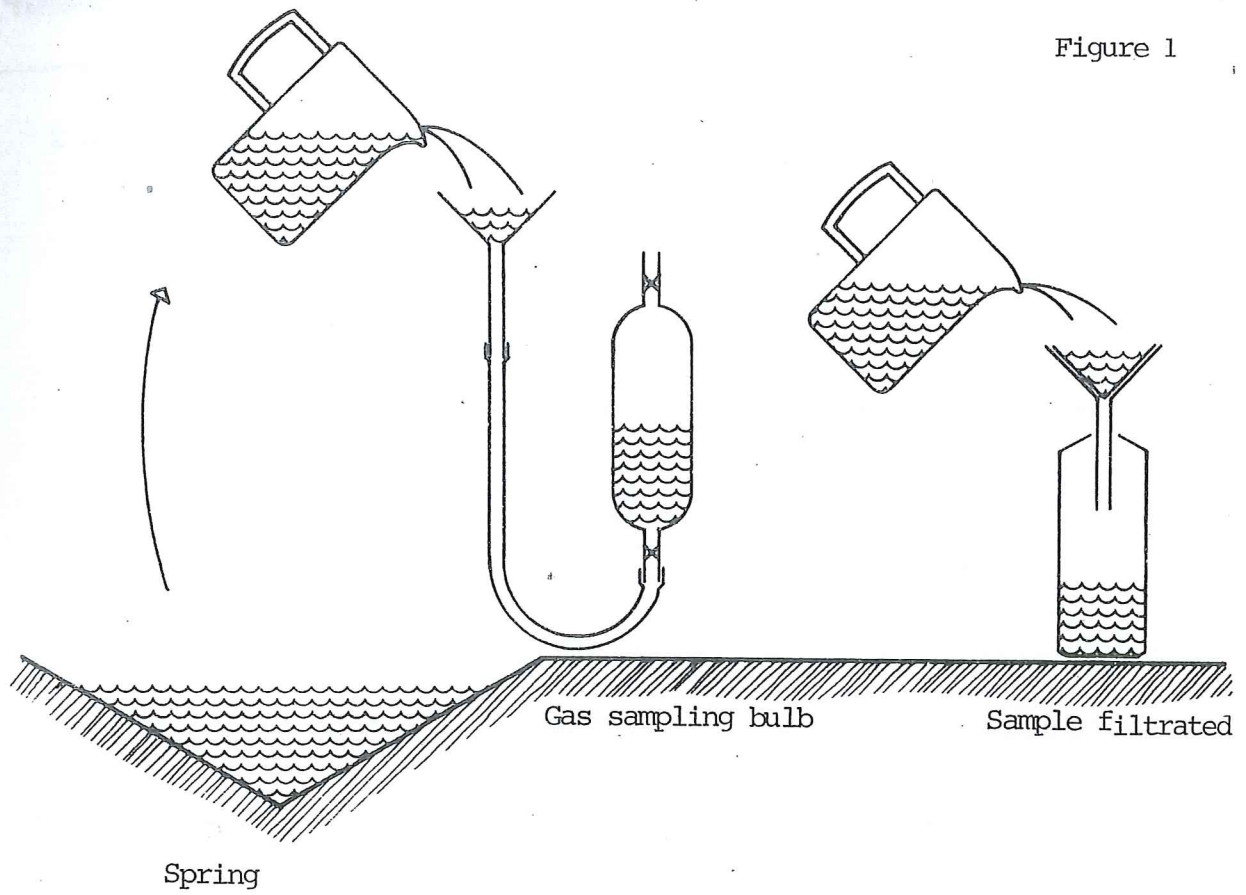
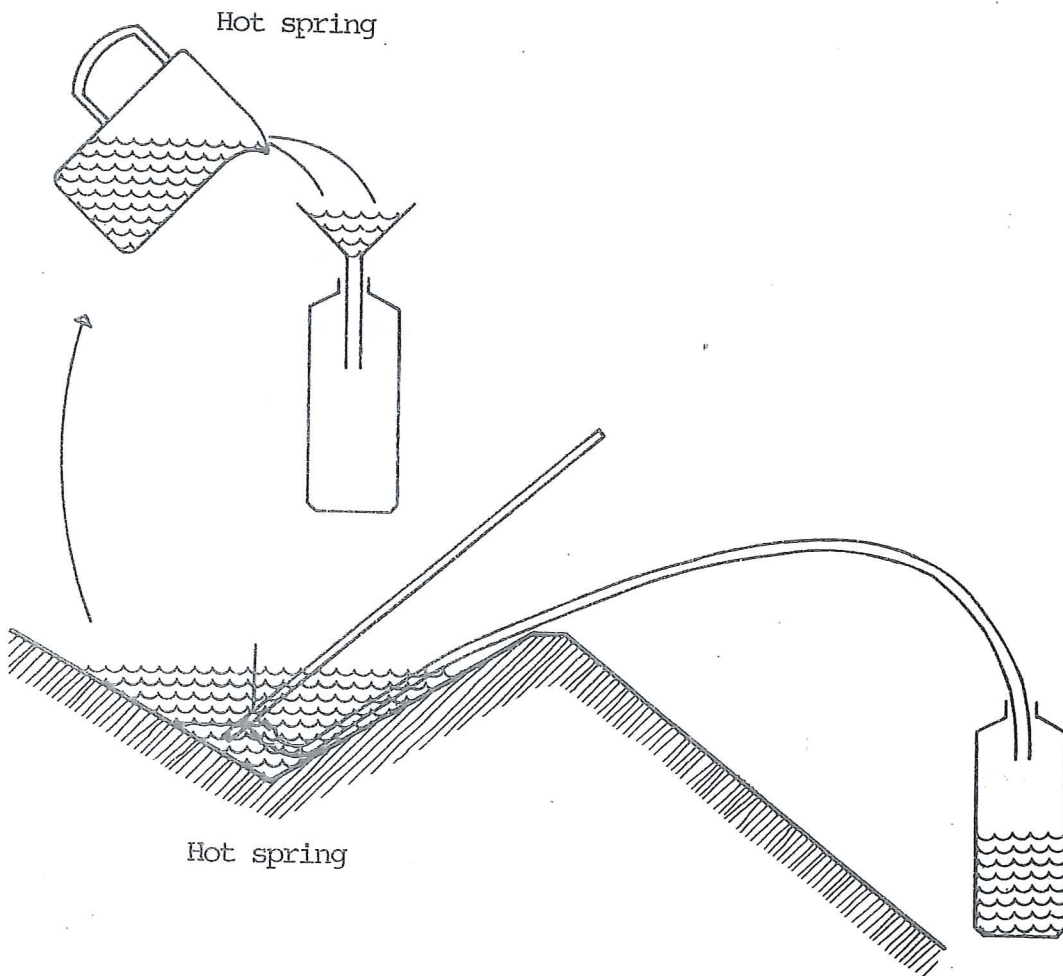
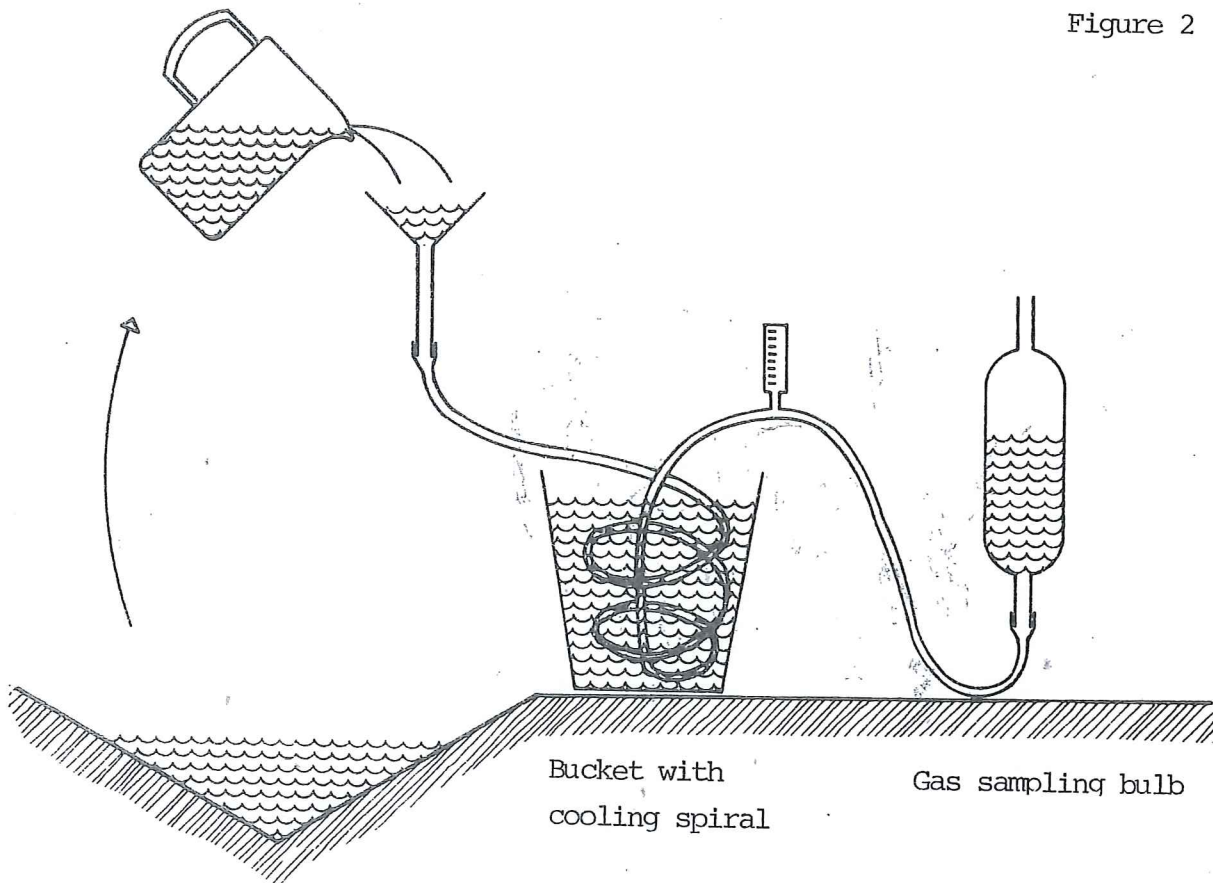


Figure 2



Appendix 3. Methods of chemical analysis.

Spectrophotometric Determination of Silica

This method is based on the reaction of silica with molybdate ions at pH of 1.2 - 1.5. A green silicomolybdate complex is formed which is determined by spectrophotometry.

If the concentration of silica in thermal water is higher than 100 ppm, the silica polymerizes and if the polymerized silica will not react with molybdate in the cold. Treatment with alkali converts it all to the ionic state.

As described under sample collection it is desirable to dilute samples containing more than 100 ppm SiO_2 sufficiently to bring the final silica concentration below 100 ppm. When this is done, later analysis should follow the procedure described for samples containing less than 100 ppm SiO_2 . Dilution below 100 ppm is necessary for saline waters. The silica in excess of this concentration will precipitate upon storage for one week or less.

The adopted procedure covers the concentration range of 20 - 500 ppm. Higher concentrations can be determined by taking smaller aliquot. No interference will occur from elements present in the thermal waters. Only colour or turbidity of the sample will interfere. High concentrations of hydrogen sulphide may reduce the silicomolybdate complex to molybdenum blue. This can be prevented by oxidising of the sulphide with jodine.

The main disadvantage of this method is the unstability of colour of the solution. This necessitates that samples and standards need to be prepared at the same time and that absorbance must be read between 10 and 60 minutes after developing the colour.

Average difference between duplicate samples should be 3% or less over the whole concentration range.

Reagents

- 1) Sodium hydroxide, analytical reagent grade
- 2) 1N sodium hydroxide (NaOH). Dissolve 40 g of the reagent in distilled water and dilute to 1 litre. This solution is required only for digesting samples containing more than 100 ppm SiO_2 .
- 3) Hydrochloric acid, sp. gr. 1.18 or 1.19, analytical reagent grade.
- 4) 1N hydrochloric acid (HCl) solution. Mix 40 ml of the concentrated acid with 400 ml of distilled water. This solution is needed to neutralize samples after digestion with NaOH - solution.
- 5) 6N hydrochloric acid (HCl) solution. Mix 240 ml of the concentrated acid with 200 ml of distilled water.
- 6) Ammonium molybdate solution, 10%. Dissolve 20 g of the reagent in water and dilute to 200 ml.
- 7) Potassium iodide (KI), analytical reagent grade.
- 8) Iodine resublimed (I_2), analytical reagent grade.
- 9) Iodine solution, approx. 0.1 N. Dissolve 2.5 g KI in 5 to 10 ml distilled water, add 1.77 g I_2 and dilute to 100 ml with distilled water.
- 10) Sodium thiosulphate, analytical reagent grade.
- 11) Sodium thiosulphate approx. 0.05N. Dissolve 1.2409 g of the reagent in 100 ml distilled water.
- 12) Standard silica solution 100 ppm. The solution can be obtained from manufacturers of chemicals. If not available, solution of this strength can be prepared as follows: Fuse 0.2 g of pure silica with 3g of sodium carbonate in a platinum crucible. Dissolve in water and make to 200 ml. Store in polythene bottle. It is convenient to standardise the solution by gravimetric analysis.

Standards

From the 1000 mg/l SiO_2 solution prepare standard solutions containing 20, 50, 100, 150, 200 ppm SiO_2 . Proceed as described in stage 4 - 7 of the procedure.

Procedure

Sample containing more than
100 ppm SiO₂

Samples containing less than 100
ppm SiO₂

- 1) Pipette 5 ml sample into platinum crucible or teflon beaker
- 1a) Add 0.5 ml of 1N NaOH solution
- 1b) Add 5 ml distilled water and heat on a steam bath for 10 minutes. Take care that there is no significant loss of volume by evaporation
- 1c) When cold transfer the solution to a 50 ml volumetric flask
- 1d) Add 0.5 ml of 1N HCl

- 1) Pipette 5 ml sample into 50 ml volumetric flask

If the sample contains high concentration of hydrogen sulphide follow step 2-3 otherwise go to step 4.

- 2) Add iodine solution dropwise until the solution in the volumetric flask becomes yellow or yellow brown
- 3) Destroy the yellow or yellow brown colour by adding sodium thio-sulphate dropwise
- 4) Add 2 ml of ammonium molybdate solution
- 5) Add 1 ml of 6N hydrochloric acid and fill to the mark. Mix and leave for 15 minutes
- 6) Read the absorption at 410 millimicron within 60 minutes.

Reagent

1. Sul₂
2. Sul₂
450
3. Hydr
4. Methy
5. Methy
disti
6. 1,2 d:
7. Di-soc
8. Ethyl
9. Standa:
in 500
Dilute

This spectrophotometric method is based on measurement of the blue fluoroborate-methylene blue complex. The sample is treated with hydrofluoric and sulphuric acids and the complex formed between fluoroborate ions and methylene blue is extracted into 1,2 dichloroethane. The method is rapid and intensive. A concentration range of 0.01 - 0.2 ppm B is covered, which may be extended to higher concentrations by using smaller volume of sample or by dilution.. No interference is known from other elements present in the thermal water. The method is described by Stanton and McDonald (1966). Their procedure has been slightly modified in order to adapt it for analysis of natural waters. It is essential to keep the acid concentrations at a constant level for samples and standards as there is always a slight colour extracted from blanc that is dependant upon the aqueous acidity. The colour at least is stable for several days. The 1,2 dichloroethane tends to become cloudy after extraction. This is presumably due to small droplets of water. Since the cloudy solution interferes severely with the absorption measurement it has been found to be convenient to prepare samples and standards on the day before reading the absorbance. After a period of 12 hours the 1,2 dichloroethane phase is always perfectly clear. The spectrophotometric cells should be washed with absolute ethyl alcohol. Small amounts of water in the cell may cause the organic phase to be cloudy. To avoid possible contamination of boron, it is advisable to use quartz glass spectrophotometric cells.

Reagents.

1. Sulphuric acid, sp.gr. 1.94, analytical reagent grade.
2. Sulphuric acid, 1/10 v/v. Dilute 50 ml of the concentrated acid with 450 ml of distilled water.
3. Hydrofluoric acid, 40 % W/W, analytical reagent grade.
4. Methylene blue, analytical reagent grade.
5. Methylene blue, 0.08 %. Dissolve 80 mg of the reagent in 100 ml of distilled water.
6. 1,2 dichloroethane, analytical reagent grade.
7. Di-sodium tetraborate-decahydrate, analytical reagent grade.
8. Ethyl alcohol, analytical reagent grade.
9. Standard boron solution. Dissolve 0.4408 g of di-sodium tetraborate in 500 ml distilled water. The solution contains 100 μg B per ml. Dilute further with distilled water to give solution containing 1 μg B/ml.

Standards.

1. Into 6 polythene bottles add 0, 0.2, 0.4, 0.6, 0.8 and 1.0 g of boron from the standard solution (0, 0.2, 0.4, 0.6, 0.8 and 1.0 ml respectively of the 1 g B/ml solution).
2. Add sufficient distilled water to give total volume of 5 ml.
3. Proceed as in step 2-7 of the procedure.

Procedure.

1. Pipette 5.0 ml of sample (less volume if B concentration is high) into a polythene bottle.
2. Add 1 ml of 1/10 sulphuric acid
3. Add 0.1 ml of hydrofluoric acid.
4. Add 1 ml of 0.08 % methylene blue
5. Add 8 ml of distilled water
6. Add 5 ml of 1,2-dichloroethene. Stopper the bottle and shake it vigorously for 30 sec.
7. Allow the phases to separate and transfer a sufficient quantity of the phase to silica cell and read the absorbance at 640 millimicrons. It is preferable to prepare the samples in the afternoon and read the absorbance the following morning.
8. Calculate $\mu\text{g B}$ in the sample using standard curve.

9.

$$\text{B in ppm} = \frac{\mu\text{g B in sample}}{\text{ml sample}}$$

Reference.

Stanton, R.E and McDonald, A.J., 1966. The colorimetric determination of boron in soils, sediments and rocks with methylene blue. The Analyst, vol 291, pp 775-778.

Ref
AA F

Sodium is determined by atomic absorption spectrophotometer using air acetylene flame. For standard condition the working range for Na is linear up to the concentration of $1\mu\text{g/ml}$ in aqueous solution. Other alkali metals (potassium and lithium) may interfere with sodium. This interference is overcome by adding excess of lithium to standards and samples. Suitable concentration of lithium in samples and standards is 100 ppm. The most sensitivity wavelength for sodium is at 589 nm.

Reagents.

1. Sodium standard, 1000ppm. Dissolve 2.5421 g of NaCl in 1000 ml of distilled water.
2. Lithium solution, 5000 ppm. Dissolve 26.62 g of lithium carbonate (LiCO_3), analytical reagent grade, in 250 ml 1:1 HCl and dilute to 1000 ml with distilled water.
3. If an automatic diluter is used a 100 ppm lithium solution should be used for dilution of samples and the 1000 ppm standard Na solution. Since samples are normally diluted 50 times or more it can be safely assumed that the lithium concentration in the final solution is constant.

Procedure.

1. Prepare suitable working standards (0, 0.25, 0.5, 0.75, 1.0 ppm) from the 1000 ppm sodium standard.
2. To 50 ml of each of the standard and suitably diluted samples add 1 ml of lithium solution.
3. Measure absorbance of the standards and samples. Plot the absorbance of standards against concentration. Read the concentration of the samples from the graph.

Reference.

AA Perkin Elmer. Analytical methods.

POTASSIUM

Potassium is determined by atomic absorption spectrophotometry using air acetylene flame. For standard condition the working range for potassium is linear up to concentration of approximately 2 $\mu\text{g/ml}$ in aqueous solution. Sodium may interfere slightly if present at much higher levels than the potassium. The most sensitive wavelength for potassium is at 766.5 nm.

Reagents.

1. Potassium chloride, analytical reagent grade.
2. Potassium standard, 1000 ppm. Dissolve 1.9066 g of KCl in 1000 ml distilled water.

Procedure.

1. Prepare suitable working standards (0, 0.5, 1.0, 2.0 ppm) by diluting the 1000 ppm potassium standard with distilled water.
2. Measure absorbance of standards and samples. Plot absorbance of standards against concentration. Read the concentration of samples from the graph.

Reference.

AA Perkin Elmer. Analytical methods.

2
3
4
Re
AA

metry
g range
μg/ml

Calcium is determined by using atomic absorption spectrophotometry using air acetylene flame. For standard condition the working range for calcium is linear up to concentration of approximately $7 \mu\text{g/ml}$ in aqueous solution. Silica, aluminum, phosphate, sulphate, titanium and zirconium depress the sensitivity for calcium. Lanthanum or strontium at a concentration of 0.1 to 1 % is added to samples and standards to cancel these interferences, and simultaneously, a slight ionization interference from calcium in the air acetylene flame. The most sensitive wavelength for calcium is at 422.7 nm.

Reagents.

- ce
1. Calcium carbonate, analytical reagent grade.
 2. Hydrochloric acid, sp.gr. 1.18 or 1.19, analytical reagent grade
 3. Calcium standard, 500 ppm. Add 1.249 g of calcium carbonate to about 50 ml of distilled water. Add dropwise a minimum volume of HCl (approx. 10 ml) to dissolve the CaCO_3 . Dilute to 1000 ml with distilled water.
 4. Lanthanum oxide, analytical reagent grade.
 5. Lanthanum oxide, 5 %. 58.65 g of lanthanum oxide is wetted in distilled water. Slowly add 250 ml of HCl, dilute to 1000 ml with distilled water.

Procedure.

1. Prepare suitable working standards (0, 1, 2, 5, 7 ppm) from the 500 ppm calcium standard.
2. Pipette 10 ml of each of the standards and the suitably diluted samples to polythene beakers
3. Add 2 ml of 5 % La_2O_3 solution to the standards and samples.
4. Measure absorbance of standards and samples. Plot absorbance of standards against concentration. Read the concentration in samples from the graph.

Reference.

AA Perkin Elmer, Analytical methods.

Magnesium is determined by atomic absorption spectrophotometry using air acetylene flame. For standard condition the working range for magnesium is linear up to concentration of approximately 0.5 μ g/ml in aqueous solution. Silica and aluminum depress the magnesium absorption in the air acetylene flame, but addition of lanthanum (0.1 to 1 %) will generally remove these interferences. The most sensitive wavelength for magnesium is 285.2 nm. The detection limit using this line is 0.002 ppm.

Reagents.

1. Magnesium oxide, analytical reagent grade.
2. Magnesium standard, 100 ppm. Dissolve 0.1658 g of MgO in distilled water.
3. Lanthanum oxide, analytical reagent grade.
4. Hydrochloric acid, sp.gr. 1.18 or 1.19, analytical reagent grade.
5. Lanthanum oxide, 5 %. 58.65 g of La_2O_3 is wetted in distilled water. Slowly add 250 ml HCl and dilute to 1000 ml with distilled water.

Procedure.

1. Prepare suitable working standards (0, 0.1, 0.2, 0.3, 0.4, 0.5 ppm) from the 100 ppm magnesium standard.
2. Pipette 10 ml of each of the standards and suitably diluted samples to polythene beakers.
3. Add 2 ml of 5 % La_2O_3 solution to the standards and samples.
4. Measure absorbance of standards and samples. Plot absorbance of standards against concentration. Read the concentration in samples from the graph.

Reference.

AA Perkin Elmer, Analytical methods.

Small quantities of sulphate can be determined by titration with barium perchlorate, using thorin as indicator. The titration is carried out in 80 % alcohol in the pH range 2.5 to 4.0. Before the titration the cations are removed by passing the sample through an ion exchange column. Phosphate makes the method inaccurate but it is usually absent or in very low concentration in thermal waters.

Reagents.

1. Cation exchanger (Ionenaustaucher I, Merk Art. 4765)
2. 2- propanol, analytical reagent grade.
3. Perchloric acid, sp.gr. 1.67, Analytical reagent grade.
4. Barium perchlorate, analytical reagent grade.
5. Absolute ethyl alcohol , analytical reagent grade.
6. Barium perchlorate, 0.005 M. Dissolve 2.0 g barium perchlorate trihydrate (1.68 g barium perchlorate water free) in 200 ml of distilled water and add 800 ml of ethyl alcohol. Adjust the pH to about 3.5 with perchloric acid. Standardize against sulphate standard.
7. Sodium sulphate, analytical reagent grade.
8. Sulphate standard, 1000 ppm SO_4 . Dissolve 1.4796 g of Na_2SO_4 in 1000 ml of distilled water.
9. Thorin, analytical reagent grade.
10. Thorin, 0.2 %. Dissolve 0.2 g of the reagent in 100 ml of distilled water.

Apparatus

1. 25 ml byrette with ionic exchanger. The bottom of the byrette is stopped with glass wool (or cotton wool). About 15 ml of the ionic exchanger is placed in the byrette.
2. 10 ml byrette, subdivided at 0.02 ml for barium perchlorate.
3. Magnetic stirrer.
4. Porcelain evaporating dishes.

Procedure.

1. Fill the ionic exchange byrette with the sample and pass it through the column. Fill the byrette again and pass the sample through. Fill the byrette for the third time and let the sample

- pass dropwise to the 0 mark. Dispose the effluent.
2. Pass 10 ml of sample (or less amount if the concentration of SO_4 is high) dropwise through the ionic exchange column to the porcelain evaporating dish.
 3. Add 40 ml propanol (ratio: sample/propanol 1/4)
 4. Add 3 drops of thordin indicator.
 5. Titrate with barium perchlorate using magnetic stirrer until first change from yellow to pink colour appears.
 6. Calculations.

$$\text{ppm SO}_4 = \frac{\text{ml Ba(ClO}_4\text{)} \cdot \text{N}}{\text{ml sample}} \cdot 96062$$

Reference.

Fritz, J.S. and Yamamura, S.S, 1955. Rapid microtitration of sulphate. Analytical chemistry, vol. 27, no. 9, pp 1461-1464.

A few methods have been used to determine chloride in thermal waters. The Mohr titration is the most common. Besides it an undirect determination of chloride by atomic absorption spectrometry measuring excess silver ion is used, particularly for waters high in hydrogen sulphide.

Mohr titration

This method which is described here has been modified in order to reduce the size of aliquot required. The usual Mohr titration requires 10 to 100 ml of the sample for each titration, but this modification only requires up to 10 ml of sample. The chloride is titrated with silver nitrate solution using potassium chromate as an indicator. Insoluble silver halides other than AgCl are precipitated, but their concentration in thermal water are negligible compared with those of chloride. The end point is not sharp. It is marked by gradual change of colour from yellow to brown. The precision of the titration depends on the skill of the analyst.

Reagents.

1. Silver nitrate, analytical reagent grade.
2. Silver nitrate solution, 0.0141 M. Dissolve 2.395 g of silver nitrate in water and dilute to 1 liter in a volumetric flask.
3. Potassium chromate, analytical reagent grade.
4. Potassium chromate indicator, 5 %. Dissolve 5 g of the reagent in 100 ml of water.
5. Sodium hydroxide, analytical reagent grade.
6. Sodium hydroxide solution, 1 N. Dissolve 20 g of the reagent in 500 ml of water.

The following apparatus is needed.

1. 50 ml beakers.
2. microburette (if usual byrette is used larger amount of sample is needed)
3. pipettes (0.5 ml, 1 ml, 2 ml, 5 ml)
4. glas rod

Procedure.

1. Transfer 10 ml of distilled water to each of two 50 ml beakers (blanks) and add 3 drops of potassium chromate. Titrate one of the blanks with 0.0141 silver nitrate solution to brown endpoint, stirring the solution

with the glass rod while titrating. These blanks, one untitrated and one titrated are used as references during titration of samples.

They should be prepared for each working day.

2. Transfer an aliquot of sample (0.5 to 10 ml depending on the chloride concentration to 50 ml beaker, and make the volume to approximately 10 ml with water.
3. Ensure that the pH is above 8.2. If not add sufficient amount of 1 N NaOH solution. The pH should not exceed 8.2 greatly.
4. Add 3 drops of potassium chromate indicator.
5. Titrate the sample with 0.0141 M silver nitrate solution to brown end point (the colour should match with that of the titrated blank).

6.

$$\text{Cl (in ppm)} = \frac{\text{ml AgNO}_3(\text{sample} - \text{blank}) \cdot \text{M (AgNO}_3)}{\text{ml sample}} \cdot 35457$$

FLUORIDE

The fluoride is determined using fluoride sensitive electrode and a pH/mV meter. The fluoride content of the sample can be determined directly by comparing the electrode potential reading of the sample to the electrode potential obtained in standards of known fluoride content. The comparison is made by plotting readings from standard solutions on semi-log graph paper. In the following standards and samples are diluted with ionic strength adjustment buffer, which buffer the sample at pH 5 to 6, destroys complexes and adjusts the sample to a fixed ionic strength.

Reagents.

1. TISAB buffer (ionic strength adjustment buffer) or TISAB III (concentrated). These are available from Orion Research, U.S.A., but TISAB can be prepared by the following procedure. Transfer 500 ml distilled water to 1000 ml beaker, add 57 ml glacial acetic acid, 58 g sodium chloride (analytical reagent grade) and 4 g CDTA (cyclohexylene dinitrilo tetraacetic acid; MERK Titriplex IV), analytical reagent grade). Stir to dissolve. Place the beaker in a water bath to cool it. Slowly add 5 M NaOH to the solution until the pH is between 5 and 5.5. Cool to room temperature. Pour into a 1000 ml volumetric flask, and add distilled water to the mark.
2. Fluoride standard, 100 ppm. ORION 94-09-07
3. Concentrated KCl solution. ORION 90-00-01.

Apparatus

1. pH/mV meter with expanded scale.
2. Fluoride ion electrode. Two types are available, Orion 96-09 combination electrode and Orion 94-09 solid state electrode. With the solid state electrode, single junction reference electrode must be used (Orion 99-01)
3. Beakers
4. Pipettes.

Procedure.

It is important that the samples and standards have the same temperature. It is therefore often most suitable to prepare the samples and standards on the day before the measurement is carried out.

1. Pipette 10 ml of the sample (or standard) to a beaker
2. Add 10 ml of TISAB buffer (1 ml TISAB III buffer). Store overnight.
3. Measure fluoride standard and samples on mV expanded scale. Rinse electrode between measurements with distilled water and dry with soft tissue.
4. Plot measured mV against concentration on semi log graph paper, having the concentration on the log scale and the mV on the linear scale. If the measurement is adequate a straight line should be obtained. Read the fluoride concentration from the graph.

It is important to clean the electrode immediately after use with distilled water and dry it with soft tissue.

Reference.

ORION instruction manual, fluoride electrodes model 94-09 and model 96-09.

Appendix 4. Chemical analysis.

Analysis of geothermal water from Madagascar. Concentrations in ppm.

Sample number	Temp. °C	pH/°C	SiO ₂	B	Na	K	Ca	Mg	CO ₂	SO ₄	H ₂ S	Cl	F
790001	38.5	6.95/17	133.6	1.15	1264	151.9	94.1	62.1	2698	176.6	<0.1	437	0.85
790002	45.0	7.14/17	139.6	1.26	1399	185.2	111.9	70.2	2860	204.7	<0.1	481	1.13
790003	46.0	7.40/17	148.8	1.19	1424	186.3	124.7	70.6	2816	204.0	<0.1	486	1.00
790004	51.0	7.56/18	133.4	1.18	1389	176.5	94.5	68.3	2645	199.8	<0.1	478	0.95
790005	57.5	8.21/20	68.5	0.03	122.5	5.3	18.5	1.7	111	181.9	0.2	7.2	2.57
790006	18.0	5.95/21	91.0	<0.01	20.1	11.3	26.9	17.5	459	2.0	<0.1	1.5	0.10
790007	42.5	7.85/23	55.1	0.06	84.2	5.3	77.3	1.5	58.4	349.2	<0.1	5.3	2.89
790008	45.0	6.91/30	127.6	0.07	360.2	31.5	236.3	234.7	1493	557.0	0.2	59.2	1.10
790009	57.0	6.87/23	132.6	0.07	555.8	40.7	135.3	70.2	1016	908.3	<0.1	35.4	1.38
790010	28.0	6.72/22	123.6	0.75	649.4	56.3	491.1	418.9	3634	369.2	<0.1	523	0.20
790011	24.0	6.54/23	73.7	0.24	224.5	27.9	277.9	159.7	1732	104.2	<0.1	151	0.44
790012	46.0	6.98/23	107.0	0.06	351.5	22.5	208.5	202.2	1152	940.1	<0.1	77.5	1.77
790013	59.0	7.00/23	90.8	0.38	439.5	33.7	45.9	4.2	547	461.5	<0.1	122	6.80
790014	78.0	7.45/32	106.1	0.22	396.2	21.0	48.3	4.7	293	422.8	<0.1	185	4.00
790015	50.0	6.94/31	35.3	0.28	94.7	11.3	33.8	17.9	336	16.4	<0.1	39.7	0.59
790016	72.0	7.35/31	97.2	0.40	694.3	77.5	97.7	32.3	1389	98.4	<0.1	282	2.00

Analysis of geothermal water from Madagascar. Concentrations in ppm.

Sample number	Temp. °C	pH/°C	SiO ₂	B	Na	K	Ca	Mg	CO ₂	SO ₄	H ₂ S	Cl	F
790017	55	8.10/28	66.9	0.03	123.8	4.1	15.5	2.9	186.0	58.9	<0.1	21.4	4.02
790018	46	7.38/20	84.1	0.08	244.4	13.1	38.3	8.3	351.0	175.0	<0.1	56.2	4.01
790019	48	7.68/33	90.7	0.18	373.4	23.2	62.0	18.0	663.2	102.0	<0.1	118.6	5.49
790020	27	6.79/32	34.6	0.01	5.9	1.5	12.8	4.8	65.4	5.1	<0.1	0.9	0.38
790021	29	6.78/27	25.6	0.25	163.6	18.6	338.5	35.7	1115.8	123.2	<0.1	140.3	0.41
790022	27	6.82/28	98.6	0.88	140.7	24.2	101.5	71.7	408.1	3.3	<0.1	30.5	0.19
790023	47	8.43/29	137.7	0.77	520.0	36.4	61.3	6.8	453.7	451.9	<0.1	205.7	5.57
790024	57	8.46/30	80.9	0.11	261.0	8.7	26.9	6.8	311.2	339.8	<0.1	70.0	4.20
790025	58	8.55/29	67.4	0.08	195.1	3.0	16.6	1.9	195.8	230.0	<0.1	40.9	2.81
790026	55	9.08/29	40.3	0.95	39.7	1.9	3.8	2.1	38.7	27.2	<0.1	13.7	4.43
790027	55	9.30/22	46.4	0.02	41.1	1.4	2.5	0.24	49.7	18.2	0.2	1.4	3.26
790028	55	9.17/28	37.4	0.01	54.4	1.3	3.1	0.28	35.7	66.3	0.2	3.1	2.01
790029	56.5	9.32/29	40.8	0.01	57.2	1.3	3.1	0.13	32.2	73.2	<0.1	3.5	2.21
790030	55	9.30/26	38.6	0.01	55.1	1.3	3.1	0.24	36.5	69.1	0.2	3.1	2.28
790031	56	9.26/30	42.2	0.03	57.0	1.3	3.0	0.10	40.7	70.7	0.34	3.0	2.14

Chemical analysis of geothermal waters. Concentrations in ppm.

Sample number	Temp. °C	pH/°C	SiO ₂	B	Na	K	Ca	Mg	CO ₂	SO ₄	H ₂ S	Cl	F
800032	58	8.41/27	32.3	0.42	304.5	6.1	20.3	4.0	278.6	160.6	<0.1	164.8	0.75
800033	44	8.30/26	30.0	0.42	297.0	5.9	20.3	3.9	252.2	183.1	0.2	165.8	0.79
800034	34	8.37/27	18.6	0.68	282.0	5.2	6.8	10.0	366.7	147.0	0.17	73.2	1.08
800035	28	7.48/27	14.7	0.07	26.1	2.6	77.6	5.8	212.7	20.0	0.2	42.5	0.20
800036	26.5	7.24/26	15.4	0.07	25.5	2.4	77.6	4.9	199.5	22.1	0.17	30.0	0.17
800037	48.5	7.13/28	36.1	1.35	670.9	40.2	28.9	9.5	965.0	19.6	0.17	454.5	0.86
800038	42	7.83/26	12.7	0.02	12.1	9.2	12.0	3.3	45.6	20.7	0.17	7.9	0.13
800039	38	7.99/26	14.7	0.02	10.3	9.3	11.9	3.4	50.0	18.4	0.1	4.8	0.16
800040	44	8.14/27	14.8	0.02	30.5	6.2	17.4	1.9	71.9	21.6	0.2	15.8	0.17
800041	43	8.22/27	18.1	0.03	36.0	7.6	22.4	2.1	80.7	20.2	0.2	30.0	0.19
800042	45	8.03/25	16.8	0.02	22.2	7.0	21.0	2.4	67.6	23.2	<0.1	10.1	0.17
800043	44.5	7.51/25	26.0	1.45	997.3	32.1	159.4	18.3	172.9	671.0	0.3	1345.3	1.35
800044	50	7.55/21	29.5	0.13	144.0	5.3	341.9	0.65	11.4	1098.6	2.9	35.3	2.88
800045	48	7.53/24	30.4	0.13	139.5	4.6	334.0	0.66	18.0	1080.7	1.0	28.7	3.2
800046	30	8.45/25	26.9	0.01	9.4	2.0	12.7	1.08	33.2	8.6	6.8	2.8	0.38
800047	39.5	7.47/29	71.7	1.09	169.2	8.7	16.9	2.8	66.7	142.7	19.1	144.1	6.9
800048	51	8.68/22	44.4	0.01	104.8	1.6	11.9	0.26	56.1	177.9	0.3	13.6	3.9
800049	42	8.37/21	43.4	0.04	106.1	1.6	11.5	0.23	58.1	179.2	<0.1	14.7	4.0
800050	50	8.53/21	45.0	0.09	220.0	5.9	81.1	0.47	17.2	496.7	<0.1	89.5	6.2
800051	46	7.45/25	44.6	0.05	189.2	6.5	57.2	0.88	33.0	414.9	<0.1	51.2	4.7

Sample number	Temp °C	pH/°C	SiO ₂	B	Na	K	Ca	Mg	CO ₂	SO ₄	H ₂ S	Cl	F
800078	29	7.67/19	75.2	1.57	1018.7	139.3	67.6	41.6	22.8	204.9	0.34	536.5	0.97
800079	65	9.45/28	79.7	0.05	149.6	4.58	5.72	0.132	14.4	188.9	<0.1	74.7	5.5
800080	38	9.28/28	75.0	0.05	123.3	4.0	8.23	0.589	27.4	159.3	0.17	73.0	4.4
800081	35	9.05/28	54.7	0.05	92.3	3.1	5.72	1.732	36.4	111.3	0.17	50.2	3.5
800082	36	8.80/27	55.0	0.05	81.3	2.87	9.42	1.711	32.1	101.1	<0.1	50.0	3.1
800083	59	7.62/23	64.1	0.08	279.2	10.8	19.1	3.722	476.3	104.8	0.20	46.5	6.5
800084	60	7.67/23	72.6	0.09	274.1	10.4	18.9	3.78	410.3	146.9	<0.1	76.6	4.0
800085	40	7.63/24	49.4	0.03	121.6	4.9	5.33	1.40	146.4	30.8	0.17	16.1	1.8
800086	30	7.32/23	60.4	0.02	141.4	4.58	5.28	1.27	142.0	31.1	<0.1	21.4	1.6
800087	40	7.49/23.5	86.3	0.15	306.8	17.1	33.2	3.54	322.1	256.1	0.20	140.0	4.0
800088	50	7.37/23	95.1	0.21	349.2	21.1	43.6	4.00	300.0	334.8	0.17	188.0	3.3
800089	63	7.61/24	102.6	0.18	328.3	20.9	42.8	4.31	344.0	322.6	0.17	154.5	4.6
800090	36	7.42/23	51.4	0.04	104.5	3.98	8.21	2.21	256.5	27.1	<0.1	19.4	2.0
800091	52	8.11/24.5	88.1	0.02	178.5	5.14	15.1	3.93	335.4	68.5	<0.1	31.0	3.5
800092	48	7.87/23.5	67.7	0.02	159.6	4.71	15.2	3.98	322.4	65.1	<0.1	29.4	3.0
800093	45	7.84/27	55.3	0.19	242.9	7.53	6.67	0.16	93.7	67.5	<0.1	296.5	13.1
800094	39	7.45/24	19.1	0.06	14.7	13.7	17.6	6.27	179.8	17.1	<0.1	11.1	0.27
800095	40	8.16/24	17.2	0.16	175.1	1.55	1.71	0.16	197.4	106.1	<0.1	32.5	0.76
800096	42	8.39/23	16.2	0.16	175.1	1.44	1.65	0.13	204.0	106.8	<0.1	32.5	0.80
800097	40	9.25/22	87.1	0.03	69.5	1.13	12.4	0.08	111.0	16.6	<0.1	15.9	4.3
800098	48	9.47/22	13.7	0.06	69.5	1.06	11.5	0.04	74.2	17.0	<0.1	10.2	0.27
800099	51	9.40/21	89	0.03	69.5	1.04	1.07	0.04	93.4	16.9	<0.1	11.3	4.3
800100	43	9.25/21	86.1	0.03	80.0	1.11	1.10	0.03	269.4	16.4	<0.1	17.0	4.4

no	°C	pH/°C	SiO ₂	B	Na	K	Ca	Mg	CO ₂	SO ₄	H ₂ S	Cl	F
800101	28	7.56/22	82.1	<0.01	27.0	21.1	24.7	19.6	267.2	3.7	<0.1	<3.0	0.47
800102	38	7.18/22	22.8	<0.01	15.1	3.95	38.7	4.55	729.8	8.5	<0.1	10.1	0.08
800103	27	8.21/22	20.0	<0.01	14.2	3.68	37.9	4.47	619.7	7.7	<0.1	11.1	0.06
800104	42	7.18/22	28.0	<0.01	14.0	3.79	38.3	4.56	305.1	10.0	<0.1	11.5	0.12
800105	43	8.16/22	22.4	<0.01	15.3	3.74	37.7	4.5	208.4	8.4	<0.1	9.1	0.06
800106	38	8.19/23	84.3	<0.01	28.6	19.2	25.2	19.3	212.2	3.5	<0.1	<3.0	0.35
800107	33	7.25/26	127.2	1.26	1203.3	86.7	169.3	141.0	1267.7	55.6	0.2	1806	0.20
800108	28	7.12/26	28.3	1.64	2118.0	114.3	103.2	402.3	168.7	566.5	<0.1	4278	0.37
800109	37	7.28/26	84.2	1.59	1613.8	95.9	143.0	221.5	190.1	268.0	0.2	2855	0.29
800110	41	7.10/20	175.7	1.29	1117.9	173.0	109.9	63.4	2763.4	203.5	<0.1	516.5	0.89
800111	22	6.70/21	158.1	1.50	1311.2	209.3	114.1	70.6	2411.6	203.9	<0.1	496.7	1.1
800112	20	7.19/20	26.3	<0.01	3.6	1.8	6.2	5.34	120.3	3.2	<0.1	4.7	0.06
800113	51	7.11/15	62.9	0.108	355.0	14.3	162.3	2.1	27.5	792.1	0.2	285.5	3.9
800114	36	6.80/16	53.6	0.01	106.7	7.5	48.6	5.69	36.5	218.1	<0.1	83.5	1.1
800115	31	7.91/17	45.7	0.06	195.0	8.1	68.6	0.84	36.5	472.5	<0.1	62.0	5.4

Analysis of geothermal water from Madagascar. Concentrations in ppm.

Sample number	Temp. °C	pH/°C	SiO ₂	B	Na	K	Ca	Mg	CO ₂	SO ₄	H ₂ S	Cl	F
800116	51	6.44/21	52.9	0.02	133.3	2.4	8.4	0.5	62.8	176.5	0.1	14.8	4.5
800117	24	7.46/21	33.9	0.01	5.0	0.1	8.1	5.6	58.6	2.4	0.1	1.3	0.11

Appendix 5. Chemical geothermometry results.

	Number of sample	$T_{measured}$	$T_{chalcodyny}$	T_{quartz}	$T_{amorphous silica}$	T_{Na-K}	$T_{Na-K-Ca}^{\beta=4/3}$	$T_{Na-K-Ca}^{\beta=1/3}$	$T_{Na-K feldspar equilibrium}$	$T_{Na-K-Ca}$ (CO ₂ corrected)	$T_{Na-K-Ca}$ (Mg-corrected)
Antsirabe, source de lac	790001	38.5	128	154	32	208		215	215	96	60
Antsirabe, source de l'hospital	790002	45	131	157	35	220		222	225	83	62
Antsirabe, source de Ranovisy	790003	46	136	161	38	218		220	224	105	70
Antsirabe, source de Ranomafana II	790004	51	128	154	32	215		221	221	109	61
Ranomafana de Betafo	790005	57.5	87	117		112	82	135	123		120
Andronatsara-Antsira	790006	18	103	132	13				>300		
Andranomafana Ambatofinandiakana	790007	42.5	75	106		143	49	135	152		
Itasy, Andranomafana Soavinaudriana	790008	45	125	151	30	174	97	165	182	103	
Itasy, Andranomafana Mashoma	790009	57	128	154	32	151		166	161	95	51
Itasy, Andranoriangotraka	790010	28	123	149	28	173		168	181	62	
Itasy, source d'Ambaraky	790011	24	91	121	3	212	84	174	218	62	
Itasy, source des moccain d'Ifanja	790012	46	113	141	20	144	88	150	154	64	
Source de region d'Ambalobe	790013	59	103	132	12	161		176	169	82	146
Andranomafana Betsiraka	790014	78	113	141	21	128		155	138	47	127
Andranomafana Ambobaka	790015	50	53	86		207	91	175	214	85	
Andranomafana Migioky	790016	72	107	136	16	200		198	206	96	80

Calculated chemical geothermometer
Appendix 5.

	Number of sample	$F_{measured}$	$F_{chalcidony}$	F_{quartz}	amorphous silica F	F_{Na-K}	$F_{Na-K-Ca}$ $B = 4/a$	$F_{Na-K-Ca}$ $B = 1/a$	F_{Na-K} feldspar equilibrium	$F_{Na-K-Ca}$ (CO_2 corrected)	$F_{Na-K-Ca}$ (Mg-corrected)
Ankazohely	790017	55	87	116		(93)	77	125	104		81
Maevadoany	790018	46	100	128	9	129		150	139	62	74
Beangona amporiana	790019	48	104	132	12	141		156	151	72	58
Ampatamasina	790020	27	54	85		>275	25	174	> 300		42
Andranomandevy	790021	29	41	73		202	63	162	208	65	105
Sakarany	790022	27	110	136	16	254	96	192	258	91	16
Ampahaka	790023	47	130	155	34	152		171	161		119
Andranomafanakely	790024	57	97	125	7	(95)	99	132	105		64
Andranomafanabe	790025	58	86	115		108		140	119		108
Ranomafana-Est - Tamatave	790026	55	58	89		118	70	133	130		44
Miarinavaratra	790027	55	64	94		(96)	87	124	106		114
Ranomafana Ifanadiana (Source 1lb)	790028	55	54	85		(71)	66	111	84		
Ranomafana Ifanadiana (Source 1la)	790029	56.5	57	88		(69)	67	110	81		
Ranofamana Ifanadiana (Source 2a)	790030	55	55	86		(72)	66	111	83		
Ranomafana Ifanadiana (source 2b)	790031	56	58	89		(68)	66	109	80		

Calculated chemical geothermometer

Number of sample	$T_{measured}$	$T_{chalcidony}$	T_{quartz}	amorphous silica T	T_{Na-K}	$B_{Na-K-Ca}^{4/3}$	$B_{Na-K-Ca}^{1/3}$	T_{Na-K} feldspar equilibrium	$T_{Na-K-Ca}$ (CO ₂ corrected)	$T_{Na-K-Ca}$ (Mg-corrected)
Andranomafana Andonaky	58	51	82		(62)	95	115	74	21	85
Andranomafana (Amokoty)	44	48	79		(61)	93	114	73	20	84
Miary Ranomafana	34	27	60		(57)	115	118	69	22	18
Ranomafana Andrambo	28	20	60		187	21	138	195	- 43/26	/120
Ranomafana Andravidaiky	26,5	22	54		181	19	135	189	- 37/32	/115
Ranomafana Tsaripicka	48,5	56	87		138	179	174	148	53	69
Ranomafana Serp	42	14	47		121	84	259	> 300		74/94
Ranomafana Devolimanga	38	21	52		>275	83	268	> 300		73/94
Ranomafana (fiscine)	44	20	52		>275	73	189	281		/124
Ranomafana Raingile	43	27	60		>275	76	192	286		/134
Ranomafana Ambilanisaba	45	24	57		>275	70	207	> 300		/129
Ranomay (Tongobory)	44,5	42	74		(91)	121	137	102	33	99
Tsiefia Andranomafana	50	47	79		100	28	110	111		
Ranomafana Fitampilo	48	48	80		(93)	25	106	104		
Andranomafana Mohicavina	30	26	74		>275	36	173	287		/128
Andranomafana Angaradoa dit Analamizina	39,5	91	119		125	104	148	136		91/92

Calculated chemical geothermometer

Number of sample	T _{measured}	T _{chalcidony}	T _{quartz}	amorphous silica T	T _{Na-K}	T _{Na-K-Ca} β ^{4/3}	T _{Na-K-Ca} β ^{1/3}	T _{Na-K feldspar equilibrium}	T _{Na-K-Ca} (CO ₂ correcte)	T _{Na-K-Ca} (Mg-corrected)	
Mabatsinjs Ambohipano	800052	40	109	136	10	118	82	137	128	15/50	-
Ranomafana Anosibe	0053	49	98	126	7	128	86	143	138	18/54	-
Ramainandro	0054	42	(75)	104		165	174	185	179	64/69	62/65
Henikenina Quest	0055	28		52					>300		
Henikenina Est	0056	25	LOST IN TRANSIT								
Andranonafana Vohidambo	0057	49	63	94		139	27	125	149		
Ranomafana Tsangandrano	0058	69	87	116		139	116	157	149		
Ranomafana Ampasimihebo	0059	42	84	113		143	56	138	152		
Ranomafana Kelipetaka	0060	59	88	117		142	57	138	151		
Ranomafana d'Antsira	0061	47	76	106		143	52	138	153		
Ranomafana Laondany	0062	53	67	97		99	18	105	110		
Ranomafana Langainony	0063	46	82	112		133	51	132	143		
Ranomafana Sahavatoana	0064	39	65	96		108	12	106	119		
Ranomafana Imody	0065	48	76	106		100	87	131	111		
Ambohibato	0066	25	69	99		124	73	137	134		
Mahasoa	0067	28	52	84		137	78	144	147		

Calculated chemical geothermometer

Number of sample	T _{measured}	T _{chalcidony}	T _{quartz}	amorphous silica T	T _{Na-K}	T _{Na-K-Ca} B ⁴ / ₃	T _{Na-K-Ca} B ¹ / ₃	T _{Na-K feldspar equilibrium}	T _{Na-K-Ca} (CO ₂ corrected)	T _{Na-K-Ca} (Mg-corrected)
Mafana	0068	48	72	103	115	41	122	126		
Antsirasira	0069	27	75	105	139	47	133	149		
Ambia-Ouest	0070	46	59	90	123	101	146	134		91/90
Ambia-Sud-Est	0071	55	53	84	119	86	139	129		/82
Antsira	0072	51	115	141	154	139	171	163		
Kirooa	0073	30	64	94	131	80	142	141		/82
Panmafana de Bevoho on Anstrotsy	0074	39	111	138	159	142	173	167		
Vongoho	0075	41	111	138	154	135	170	163		
Analabe	0076	29	101	128	153	135	169	162		
Andranmandevy	0077	46	113	140	254	309	252	258		59/38
Amberobe	0078	29	93	122	224	227	222	229		53/55

Calculated chemical geothermometer

Number of sample	F _{measured}	F _{chalcocony}	F _{quartz}	amorphous silica T	T _{Na-K}	F _{Na-K-Ca} ^{4/3}	F _{Na-K-Ca} ^{1/3}	T _{Na-K} feldspar equilibrium	T _{Na-K-Ca} (CO ₂ corrected)	T _{Na-K-Ca} (Mg-corrected)
Ranomafana ifanara sandry	0079	65	79	108	6	(88)	107	99		-
Ranomafana Vohitsara	0080	38	80	110	3	(92)	91	103		-
Ranomafana Ambilanifotsialana	0081	35	69	99		(94)	87	105		72/62
Ranomafana Vohibato	0082	36	77	106		(97)	72	108		/23
Ranomafana Doany	0083	59	85	114		104	117	115	50/67	84/62
Androranga	0084	60	92	120	2	102	115	113	65/84	83/83
Andranomlolo Doany	0085	40	71	101		107	108	118	53/76	80/71
Andranomafanahely-Doany	0086	30	82	111		(91)	108	103	33/49	76/66
Ankiakabe	0087	40	102	129	10	132	122	142	55/78	109/117
Ranomafana Andranomadio	0088	50	107	134	14	140	125	149	57/81	118/128
Ranomafana d'Ambodiangezaka	0089	63	112	139	18	143	124	153	62/62	113/127
Ranomafana d'Aniramonta	0090	36	73	103		103	88	114	32/62	72/65
Ranomafana de Marolakana	0091	52	103	130	11	(84)	89	95	41/66	71/66
Ranomafana Antsasaka	0092	48	88	117		(85)	85	97	34/62	70/62
Soatanimbary	0093	45	77	107		(88)	129	100	75/81	
Mahabo	0094	39	29	62	>	> 275	91	>300	36/159	61/77

Calculated chemical geothermometer

Number of sample	$F_{measured}$	$F_{chalcodyny}$	F_{quartz}	$F_{amorphous\ silica}$	F_{Na-K}	$F_{Na-K-Ca}^{B^4/3}$	$F_{Na-K-Ca}^{B^1/3}$	$F_{Na-K-Ca}$ equilibrium	$F_{Na-K-Ca}$ (CO ₂ corrected)	$F_{Na-K-Ca}$ (Mg-corrected)
Folakara	28	99	126	7	>275	106	272	> 300	46/156	31/34
Antanandava	38	37	68		>275	38	183	> 300	-15/83	- /110
Berohay	27	31	63		>275	36	181	> 300		- /110
Ampoza Bebai	42	45	77		>275	37	184	> 300	- 9/90	- /110
Ankilimahasoa	43	36	68		>275	38	180	> 300		- /110
Bemonto	38	100	128	9	>275	103	262	> 300		31/34
Tabalahely (Nos Be)	33	126	151	29	155	167	179	164	72/79	19/16
Tabalahoriko (Nos Be)	28	45	77		129	212	178	146	116/94	
Bejofo	37	99	128	9	138	184	175	147	99/88.6	
Sahasarotra	41	149	171	48	240	222	227	244	94/97	50/52
Antsirabe (Source froide)	22	141	164	42	244	237	232	248	96/94	52/49
Antsirabe (eau domestique)	20	42	74		>275	37	211	> 300		
Malailay	51	84	113		107	78	131	118	-	-
Malailay	36	75	105		152	71	147	162		- /100
Ranomafanai Ankoahabe	31	67	98		109	72	130	120		-

Calculated chemical geothermometer

- Appendix 6. Computer calculations.
- 6.1 Computer calculations at measured temperature.
 - 6.2 Computer calculations at quartz temperature.

Appendix 6.1 Computer calculations at measured temperature.

Appendix 6. Computer calculations.

6.1 Computer calculations at measured temperature.

6.2 Computer calculations at quartz temperature.

Appendix 6.1 Computer calculations at measured temperature.

ORKUSTOFNUN JHD
1980-11-14 HQRDUR

MADAGASCAR

7909210001 SOURCE DE LAC, ANTSIRABE-VILLE, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE		REFERENCE TEMP.	DEGREES C	38.5 (MEASURED)
PH/DEG.C	6.95/17.0	GAS (VOL.Z)				
SI02	133.60	CO2		SAMPLING PRESSURE	BARS ABS.	
NA	1263.70	H2S		DISCHARGE ENTHALPY	MJ/OL/KG	
K	151.90	H2		DISCHARGE	KG/SEC.	0.0
CA	94.10	O2		MEASURED TEMPERATURE	DEGREES C	38.5
MG	62.100	CH4		RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
CO2	2698.00	N2		EH/TEMP.	MV/DEG.C	0.000/ 0.0
SO4	176.60					
H2S	0.14					
CL	437.00					
F	0.85	LITERS GAS PER 'KG		MEASURED DOWNHOLE TEMP.	DEGREES C/METERS	FLUID INFLOW
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	/			DEPTH (METERS)
AL	0.0000			0.0	0.0	0.0
B	1.1500	CONDENSATE (PPM)		0.0	0.0	0.0
FE	0.0000	PH/DEG.C	/	0.0	0.0	0.0
NH3	0.0000	CO2		0.0	0.0	0.0
*		H2S		0.0	0.0	0.0
*		NA		0.0	0.0	0.0
*				0.0	0.0	0.0
				0.0	0.0	0.0
		CONDENSATE WITH NaOH (PPM)		0.0	0.0	0.0
		CO2		0.0	0.0	0.0
		H2S		0.0	0.0	0.0

IONIC STRENGTH = 0.07148

IONIC BALANCE : CATIONS (MOL.EQ.)0.06740817
ANIONS (MOL.EQ.)0.06444118
DIFFERENCE (%) 4.50

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	133.61	CO2	2698.00	CO2	0.429E+00
NA	1263.70	H2S	0.14	H2S	0.262E-04
K	151.89	H2	0.00	H2	0.000E+00
CA	94.10	O2	0.00	O2	0.000E+00
MG	62.095	CH4	0.00	CH4	0.000E+00
SO4	176.60	N2	0.00	N2	0.000E+00
CL	436.96	NH3	0.00	NH3	0.000E+00
F	0.85			H2O	0.679E-01
DISS.S.	0.00			TOTAL	0.497E+00
AL	0.0000				
B	1.1499	H2O (%)		0.00	
FE	0.0000	BOILING PORTION		0.00	

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.832	KSO4-	0.801	FE++	0.433	FECL+	0.785
OH-	0.779	F-	0.779	FE+++	0.202	AL+++	0.202
H3SI04-	0.785	CL-	0.773	FE0H+	0.797	AL0H+	0.420
H2SI04--	0.420	NA+	0.785	FE(OH)3-	0.797	AL(OH)2+	0.801
H2BO3-	0.766	K+	0.773	FE(OH)4--	0.411	AL(OH)4-	0.791
HCO3-	0.785	CA++	0.433	FE0H++	0.411	ALSO4+	0.791
CO3--	0.400	MG++	0.471	FE(OH)2+	0.801	AL(SO4)2-	0.791
HS-	0.779	CAHCO3+	0.807	FE(OH)4-	0.801	ALF++	0.420
S--	0.411	MGHCO3+	0.785	FES04+	0.797	ALF2+	0.801
HSO4-	0.791	CAOH+	0.807	FECL++	0.411	ALF4-	0.791
SO4--	0.388	MGOH+	0.812	FECL2+	0.797	ALF5--	0.400
NASO4-	0.801	NH4+	0.766	FECL4-	0.785	ALF6----	0.128

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-6.855	MG++	45.02	-2.732	FE(OH)3	0.00	0.000
OH-	0.00	-6.613	NACL	0.93	-4.796	FE(OH)4-	0.00	0.000
H4SI04	213.12	-2.654	KCL	0.07	-5.998	FECL+	0.00	0.000
H3SI04-	0.41	-5.364	NASO4-	7.78	-4.185	FECL2	0.00	0.000
H2SI04--	0.00	-9.754	KSO4-	2.57	-4.721	FECL++	0.00	0.000
NAH3SI04-	0.23	-5.706	CASO4	7.69	-4.248	FECL2+	0.00	0.000
H3BO3	6.54	-3.976	MGSO4	17.05	-3.849	FECL3	0.00	0.000
H2BO3-	0.04	-6.178	CACO3	2.17	-4.664	FECL4-	0.00	0.000
H2CO3	724.48	-1.933	MGCO3	1.27	-4.822	FES04	0.00	0.000
HCO3-	2956.68	-1.315	CAHCO3+	55.54	-3.260	FES04+	0.00	0.000
CO3--	2.30	-4.416	MGHCO3+	46.58	-3.263	AL+++	0.00	0.000
H2S	0.07	-5.717	CAOH+	0.00	-8.478	ALOH++	0.00	0.000
HS-	0.07	-5.659	MGOH+	0.00	-7.410	AL(OH)2+	0.00	0.000
S--	0.00	-15.384	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.507	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-7.807	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	149.46	-2.808	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.025	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.85	-4.349	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	436.36	-1.910	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	1261.79	-1.261	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	151.11	-2.413	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	68.95	-2.764	FE(OH)2+	0.00	0.000	ALF6----	0.00	0.000

IONIC STRENGTH = 0.07066

IONIC BALANCE : CATIONS (MOL.EQ.)0.06698809
ANIONS (MOL.EQ.)0.06400436
DIFFERENCE (%) 4.56

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.21

QUARTZ	154.0
CHALCEDONY	125.2
NAK	217.6

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.212 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-20.278	99.999	ALBITE LOW	-19.251	99.999	ANALCINE	-15.310	99.999
ANHYDRITE	-4.843	-6.347	CALCITE	-8.545	-7.942	CHALCEDONY	-3.403	-2.654
MG-CHLORITE	-83.674	99.999	FLUORITE	-10.805	-12.044	GOETHITE	-8.458	99.999
LAUMONDITE	-31.020	99.999	MICROCLINE	-22.154	99.999	MAGNETITE	-32.688	99.999
CA-MONTHOR.	-104.338	99.999	K-MONTHOR.	-52.154	99.999	MG-MONTHOR.	-105.102	99.999
NA-MONTHOR.	-51.524	99.999	MUSCOVITE	-25.813	99.999	PREHNITE	-39.916	99.999
PYRRHOTITE	1.864	99.999	PYRITE	-51.956	99.999	QUARTZ	-3.791	-2.654
WAIKAKITE	-27.024	99.999	WOLLASTONITE	12.442	7.927	ZOISITE	38.572	99.999
EPIDOTE	-147.330	99.999						

ORKUSTOFNUN JHD
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MADAGASCAR

7909210005

RANOMAFANA DE BETAFO, BETAFO, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	8.21/20.0
SI02	68.50
NA	122.50
K	5.30
CA	18.50
MG	1.700
CO2	111.00
SO4	181.90
H2S	0.19
CL	7.20
F	2.57
DISS.SOLIDS	0.00
AL	0.0000
B	0.0300
FE	0.0000
NH3	0.0000
*	
*	
*	

GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	57.5 (MEASURED)
CO2	SAMPLING PRESSURE	BARS ABS.	
H2S	DISCHARGE ENTHALPY	MJ/UL/KG	
H2	DISCHARGE	KG/SEC.	0.0
O2	MEASURED TEMPERATURE	DEGREES C	57.5
CH4	RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0
N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C

MEASURED DOWNHOLE TEMP.
DEGREES C/METERS

FLUID INFLOW
DEPTH (METERS)

CONDENSATE (PPM)	0.0	0.0	0.0
PH/DEG.C	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
NA	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0

CONDENSATE WITH NAOH (PPM)

CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.00880

IONIC BALANCE :

CATIONS (MOL.EQ.)	0.00640634
ANIONS (MOL.EQ.)	0.00653407
DIFFERENCE (%)	-1.97

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	68.51
NA	122.50
K	5.30
CA	18.50
MG	1.700
SO4	181.90
CL	7.20
F	2.57
DISS.S.	0.00
AL	0.0000
B	0.0300
FE	0.0000

CO2	111.00
H2S	0.19
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00
H2O	0.177E+00
TOTAL	0.180E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.913	KSO4-	0.905	FE++	0.678	FECL+	0.902
OH-	0.901	F-	0.901	FE+++	0.445	AL+++	0.445
H3SI04-	0.902	CL-	0.899	FE0H+	0.905	AL0H++	0.674
H2SI04--	0.674	NA+	0.902	FE(OH)3-	0.905	AL(OH)2+	0.905
H2BO3-	0.898	K+	0.899	FE(OH)4---	0.671	AL(OH)4-	0.903
HCO3-	0.902	CA++	0.678	FE0H++	0.671	ALSO4+	0.903
CO3---	0.667	MG++	0.691	FE(OH)2+	0.905	AL(SO4)2-	0.903
HS-	0.901	CAHCO3+	0.907	FE(OH)4-	0.905	ALF++	0.674
S--	0.671	MGHCO3+	0.902	FESO4+	0.905	ALF2+	0.905
HSO4-	0.903	CAOH+	0.907	FECL++	0.671	ALF4-	0.903
SO4---	0.664	MGOH+	0.908	FECL2+	0.905	ALF5---	0.667
NASO4-	0.905	NH4+	0.898	FECL4-	0.902	ALF6----	0.403

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.876	MG++	1.21	-4.301	FE(OH)3	0.00	0.000
OH-	0.12	-5.161	NACL	0.00	-7.215	FE(OH)4-	0.00	0.000
H4SI04	105.77	-2.950	KCL	0.00	-8.991	FECL+	0.00	0.000
H3SI04-	3.57	-4.425	NASO4-	1.92	-4.792	FECL2	0.00	0.000
H2SI04--	0.00	-7.707	KSO4-	0.24	-5.753	FECL++	0.00	0.000
NAH3SI04-	0.25	-5.678	CASO4	6.90	-4.295	FECL2+	0.00	0.000
H3BO3	0.16	-5.587	MGSO4	2.18	-4.743	FECL3	0.00	0.000
H2BO3-	0.01	-6.732	CACD3	0.90	-5.044	FECL4-	0.00	0.000
H2CO3	3.73	-4.221	MGCO3	0.05	-6.242	FESO4	0.00	0.000
HCO3-	147.50	-2.617	CANCO3+	1.70	-4.773	FESO4+	0.00	0.000
CO3---	1.02	-4.768	MGHCO3+	0.11	-5.906	AL+++	0.00	0.000
H2S	0.01	-6.452	CAOH+	0.00	-7.381	AL0H++	0.00	0.000
HS-	0.17	-5.282	MGOH+	0.00	-7.246	AL(OH)2+	0.00	0.000
S--	0.00	-13.864	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-18.723	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.345	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4---	173.57	-2.743	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.342	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	2.57	-3.869	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	7.20	-3.692	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	122.08	-2.275	FE(OH)4---	0.00	0.000	ALF4-	0.00	0.000
K+	5.23	-3.874	FE(OH)++	0.00	0.000	ALF5---	0.00	0.000
CA++	15.43	-3.415	FE(OH)2+	0.00	0.000	ALF6----	0.00	0.000

IONIC STRENGTH = 0.00885

IONIC BALANCE :

CATIONS (MOL.EQ.)	0.00633188
ANIONS (MOL.EQ.)	0.00645330
DIFFERENCE (%)	-1.90

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.02

QUARTZ	115.5
CHALCEDONY	85.7
NAK	123.3

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.321 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-19.140	99.999	ALBITE LOW	-18.218	99.999	ANALCIME	-14.494	99.999
ANHYDRITE	-5.053	-6.504	CALCITE	-8.743	-8.527	CHALCEDONY	-3.214	-2.958
MG-CHLORITE	-82.112	99.999	FLUORITE	-10.669	-11.412	GOETHITE	-7.684	99.999
LAUMONITE	-29.567	99.999	MICROCLINE	-20.844	99.999	MAGNETITE	-31.212	99.999
CA-MONTHOR.	-97.453	99.999	K-MONTHOR.	-48.415	99.999	MG-MONTHOR.	-98.336	99.999
NA-MONTHOR.	-47.919	99.999	MUSCOVITE	-24.110	99.999	PREHNITE	-38.645	99.999
PYRRHOTITE	1.638	99.999	PYRITE	-48.923	99.999	QUARTZ	-3.537	-2.958
WAIKAKITE	-26.089	99.999	WOLLASTONITE	11.685	9.211	ZOISITE	-37.482	99.999
EPIDOTE	-144.484	99.999						

ORKUSTOFMUN JHD
1980-11-14 HORDUR

MADAGASCAR

7909210006

ANDRONTSARA-ANTSIRA, ENVIRONS DE ANTRIRABE, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	5.95/21.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	18.0 (MEASURED)
SiO2	91.00	CO2	SAMPLING PRESSURE	BARS ABS.	
NA	7.00	H2S	DISCHARGE ENTHALPY	MJ/OL/KG	
K	11.30	H2	DISCHARGE	KG/SEC.	0.0
CA	26.90	O2	MEASURED TEMPERATURE	DEGREES C	18.0
MG	17.500	CH4	RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0
CO2	459.00	N2	EN/TEMP.	MV/DEG.C	0.000/ 0.0
SO4	2.00		MEASURED DOWNHOLE TEMP.	DEGREES C/METERS	
H2S	0.10		FLUID INFLOW	DEPTH (METERS)	
CL	1.50				
F	0.10	LITERS GAS PER 'KG			
DISS.SOLIDS	0.00	CONDENSATE/DEG.C			
AL	0.0000				
B	0.0000	CONDENSATE (PPM)			
FE	0.0000	PH/DEG.C			
NH3	0.0000	CO2			
B	<0.01	H2S			
SO4	<2.0	NA			
F	*0.1				
		CONDENSATE WITH NaOH (PPM)			
		CO2			
		H2S			

IONIC STRENGTH = 0.00450 IONIC BALANCE : CATIONS (MOL.EQ.)0.00334085
 ANIONS (MOL.EQ.)0.00291273
 DIFFERENCE (%) 13.69

DEEP WATER (PPM)	DEEP STEAM (PPM)	GAS PRESSURES (BARS ABS.)
SiO2 91.01	CO2 459.00	CO2 0.161E+00
NA 7.00	H2S 0.10	H2S 0.225E-04
K 11.30	H2 0.00	H2 0.000E+00
CA 26.90	O2 0.00	O2 0.000E+00
MG 17.499	CH4 0.00	CH4 0.000E+00
SO4 2.00	N2 0.00	N2 0.000E+00
CL 1.50	NH3 0.00	NH3 0.000E+00
F 0.10		H2O 0.205E-01
DISS.S. 0.00		TOTAL 0.182E+00
AL 0.0000		
B 0.0000	H2O (%) 0.00	
FE 0.0000	BOILING PORTION 0.00	

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.936	KSO4-	0.932	FE++	0.758	FECL+	0.930
OH-	0.929	F-	0.929	FE+++	0.555	AL+++	0.555
H3SiO4-	0.930	CL-	0.929	FE(OH)	0.931	AL(OH)+	0.755
H2SiO4--	0.755	NA+	0.930	FE(OH)3-	0.931	AL(OH)2+	0.932
H2BO3-	0.928	K+	0.929	FE(OH)4--	0.754	AL(OH)4-	0.931
HCO3-	0.930	CA++	0.758	FE(OH)+	0.754	ALSO4+	0.931
CO3---	0.752	MG++	0.766	FE(OH)2+	0.932	AL(SO4)2-	0.931
HS-	0.929	CAHCO3+	0.933	FE(OH)4-	0.932	ALF++	0.755
S--	0.754	MGHCO3+	0.930	FES04+	0.931	ALF2+	0.932
HSO4-	0.931	CAOH+	0.933	FECL+	0.754	ALF4-	0.931
SO4--	0.749	MGOH+	0.933	FECL2+	0.931	ALF5--	0.752
NaSO4-	0.932	NH4+	0.928	FECL4-	0.930	ALF6----	0.526

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-5.967	MG++	17.05	-3.154	FE(OH)3	0.00	0.000
OH-	0.00	-8.229	NaCl	0.00	-9.569	FE(OH)4-	0.00	0.000
H4SiO4	145.56	-2.820	KCl	0.00	-9.554	FECL+	0.00	0.000
H3SiO4-	0.01	-6.878	NaSO4-	0.00	-8.174	FECL2	0.00	0.000
H2SiO4--	0.00	-12.678	KSO4-	0.00	-7.595	FECL++	0.00	0.000
NAH3SiO4-	0.00	-9.301	CASO4	0.10	-6.152	FECL2+	0.00	0.000
H3BO3	0.00	0.000	MGS04	0.14	-5.933	FECL3	0.00	0.000
H2BO3-	0.00	0.000	CACO3	0.01	-7.260	FECL4-	0.00	0.000
H2CO3	469.69	-2.121	MGCO3	0.00	-7.353	FES04	0.00	0.000
HCO3-	172.59	-2.548	CAHCO3+	1.20	-4.925	FES04+	0.00	0.000
CO3--	0.01	-6.906	MGHCO3+	1.45	-4.768	AL+++	0.00	0.000
H2S	0.09	-5.563	CAOH+	0.00	-10.342	ALOH++	0.00	0.000
HS-	0.01	-6.704	MGOH+	0.00	-9.347	AL(OH)2+	0.00	0.000
S---	0.00	-17.834	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.956	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.867	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	1.82	-4.723	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.152	FE(OH)	0.00	0.000	ALF++	0.00	0.000
F-	0.10	-5.279	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	1.50	-4.374	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	7.00	-3.516	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	11.30	-3.539	FE(OH)+	0.00	0.000	ALF5--	0.00	0.000
CA++	26.39	-3.181	FE(OH)2+	0.00	0.000	ALF6----	0.00	0.000

IONIC STRENGTH = 0.00451 IONIC BALANCE : CATIONS (MOL.EQ.)0.00334251
 ANIONS (MOL.EQ.)0.00291438
 DIFFERENCE (%) 13.68

CHEMICAL GEOTHERMOMETERS DEGREES C 1000/T DEGREES KELVIN = 3.43

QUARTZ	132.1
CHALCEDONY	102.6
NAK	401.0

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.123 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER	TEOR.	CALC.	TEOR.	CALC.	TEOR.	CALC.		
ADULARIA	-21.710	99.999	ALBITE LOW	-20.555	99.999	ANALCIME	-16.310	99.999
ANHYDRITE	-4.648	-8.150	CALCITE	-8.380	-10.332	CHALCEDONY	-3.631	-2.820
MG-CHLORITE	-85.824	99.999	FLUORITE	-11.025	-13.924	SOETHITE	-9.337	99.999
LAUMONDITE	-32.845	99.999	MICROCLINE	-23.793	99.999	MAGNETITE	-34.366	99.999
CA-MONTHOR.	-112.549	99.999	K-MONTHOR.	-56.639	99.999	MG-MONTHOR.	-113.139	99.999
NA-MONTHOR.	-55.837	99.999	MUSCOVITE	-27.885	99.999	PREHNITE	-41.631	99.999
PYRRHOTITE	2.156	99.999	PYRITE	-55.563	99.999	QUARTZ	-4.099	-2.820
WAIRAKITE	-28.223	99.999	WOLLASTONITE	13.374	5.812	ZOISITE	-40.065	99.999
EPIDOTE	-151.244	99.999						

ORKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

7909270010

ANDRANORIANSTRAKA, ANALAVORY-MONLOUP-ITASY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

PH/DEG.C	6.72/22.0
SI02	123.50
NA	649.40
K	56.30
CA	491.10
MG	418.900
CO2	3634.00
SO4	369.20
H2S	0.00
CL	522.70
F	0.20
DISS.SOLIDS	0.00
AL	0.0000
B	0.7500
FE	0.0000
NH3	0.0000
H2S	<0.1
*	
*	

STEAM SAMPLE

GAS (VOL.Z)
CO2
H2S
H2
O2
CH4
N2

LITERS GAS PER 'KG
CONDENSATE/DEG.C

CONDENSATE (PPM)
PH/DEG.C
CO2
H2S
NA

CONDENSATE WITH NaOH (PPM)

CO2
H2S

REFERENCE TEMP. DEGREES C 28.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/KG
DISCHARGE KG/SEC. 0.0

MEASURED TEMPERATURE DEGREES C 28.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EI/TEMP. MV/DEG.C 0.000/ 0.0

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0

IONIC STRENGTH = 0.10353

IONIC BALANCE : CATIONS (MOL.EQ.)0.08041151
ANIONS (MOL.EQ.)0.07622166
DIFFERENCE (%) 5.35

DEEP WATER (PPM)

SI02	123.51
NA	649.40
K	56.30
CA	491.10
MG	418.866
SO4	369.19
CL	522.66
F	0.20
DISS.S.	0.00
AL	0.0000
B	0.7499
FE	0.0000

DEEP STEAM (PPM)

CO2	3634.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.578E+00
H2S	0.000E+00
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.377E-01
TOTAL	0.615E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.816	KSO4-	0.779	FE++	0.393	FECL+	0.760
OH-	0.752	F-	0.752	FE+++	0.174	AL+++	0.174
H3SI04-	0.760	CL-	0.744	FE0H	0.774	ALOH++	0.379
H2SI04--	0.379	NA+	0.760	FE(OH)3-	0.774	AL(OH)2+	0.779
H2BO3-	0.735	KA+	0.744	FE(OH)4---	0.369	AL(OH)4-	0.767
HCO3-	0.760	CA++	0.393	FE0H++	0.369	ALSO4+	0.767
CO3--	0.356	MG++	0.437	FE(OH)2+	0.779	AL(SO4)2-	0.767
HS-	0.752	CAHCO3+	0.786	FE(OH)4-	0.779	ALF++	0.379
S---	0.369	MGHCO3+	0.760	FESO4+	0.774	ALF2+	0.779
HSD4-	0.767	CAOH+	0.786	FECL++	0.369	ALF4-	0.767
SO4---	0.343	MGOH+	0.792	FECL2+	0.774	ALF5---	0.356
NASO4-	0.779	NH4+	0.735	FECL4-	0.760	ALF6---	0.099

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

HI (ACT.)	0.00	-6.689	MG++	305.25	-1.901	FE(OH)3	0.00	0.000
OH-	0.00	-7.080	NACL	0.40	-5.160	FE(OH)4-	0.00	0.000
H4SI04	197.35	-2.688	KCL	0.03	-6.449	FECL+	0.00	0.000
H3SI04	0.18	-5.735	NASO4-	4.93	-4.383	FECL2	0.00	0.000
H2SI04--	0.00	-10.422	KSO4-	1.14	-5.073	FECL1+	0.00	0.000
NAH3SI04-	0.05	-6.382	CASO4	48.27	-3.450	FECL2+	0.00	0.000
H3BO3	4.27	-4.160	HGSO4	114.19	-3.023	FECL3	0.00	0.000
H2BO3-	0.02	-6.584	CACO3	5.45	-4.264	FECL4-	0.00	0.000
H2CO3	1280.36	-1.685	MGCO3	4.49	-4.273	FESO4	0.00	0.000
HCO3-	3405.44	-1.253	CAHCO3+	234.11	-2.635	FESO4+	0.00	0.000
CO3--	1.65	-4.560	MGHCO3+	313.30	-2.435	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-8.293	ALOH++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-7.144	AL(OH)2+	0.00	0.000
S---	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.327	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSD4-	0.00	-7.607	FE+	0.00	0.000	ALSO4+	0.00	0.000
SO4---	239.22	-2.604	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.588	FE0H	0.00	0.000	ALF++	0.00	0.000
F-	0.20	-4.978	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	522.40	-1.832	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	648.28	-1.550	FE(OH)4---	0.00	0.000	ALF4-	0.00	0.000
K+	55.95	-2.844	FE(OH)++	0.00	0.000	ALF5---	0.00	0.000
CA++	381.90	-2.021	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.10229

IONIC BALANCE : CATIONS (MOL.EQ.)0.07978650
ANIONS (MOL.EQ.)0.07559319
DIFFERENCE (%) 5.40

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.32

QUARTZ	149.4
CHALCEDONY	120.4
NAK	182.2

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.			
ADULARIA	-20.979	99.999	ALBITE LOW	-19.889	99.999	ANALCINE	-15.803	99.999
ANHYDRITE	-4.739	-5.495	CALCITE	-8.454	-7.434	CHALCEDONY	-3.516	-2.688
MG-CHLORITE	-84.709	99.999	FLUORITE	-10.907	-12.629	GOETHITE	-8.900	99.999
LAUMONDITE	-31.912	99.999	MICROCLINE	-22.958	99.999	MAGNETITE	-33.533	99.999
CA-MONTHOR.	-108.402	99.999	K-MONTHOR.	-54.374	99.999	MG-MONTHOR.	-109.080	99.999
NA-MONTHOR.	-53.659	99.999	MUSCOVITE	-26.834	99.999	PREHNITE	-40.737	99.999
PYRRHOTITE	2.007	99.999	PYRITE	-53.760	99.999	QUARTZ	-3.944	-2.688
WAIKAKITE	-27.605	99.999	WOLLASTONITE	12.902	8.265	ZOISITE	-39.281	99.999
EPIDOTE	-149.217	99.999						

ORKUSTOFNUN JMD
1980-11-14 HQRDUR

MADAGASCAR

7709270011

SOURCE D'ANBARAKY, ANALAVORY-ITASY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE		REFERENCE TEMP.	DEGREES C	24.0 (MEASURED)
PH/DEG.C	6.54/23.0	GAS (VOL.%)		SAMPLING PRESSURE	BARS ABS.	
SI02	73.70	CO2		DISCHARGE ENTHALPY	KJ/OL/KG	
NA	224.50	H2S		DISCHARGE	KG/SEC.	0.0
K	27.90	H2		MEASURED TEMPERATURE	DEGREES C	24.0
CA	277.90	O2		RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
MG	159.700	CH4		EH/TEMP.	MV/DEG.C	0.000/ 0.0
CO2	1732.00	N2		MEASURED DOWNHOLE TEMP.	DEGREES C/METERS	
SO4	104.20			FLUID INFLOW	DEPTH (METERS)	
H2S	0.10					
CL	151.00	LITERS GAS PER 'KG				
F	0.44	CONDENSATE/DEG.C				
DISS.SOLIDS	0.00					
AL	0.0000	CONDENSATE (PPM)				
B	0.2400	PH/DEG.C				
FE	0.0000	CO2	0.0			
NH3	0.0000	H2S	0.0			
*		NA	0.0			
*			0.0			
*			0.0			
		CONDENSATE WITH NAOH (PPM)	0.0			
		CO2	0.0			
		H2S	0.0			

IONIC STRENGTH = 0.04496

IONIC BALANCE :

CATIONS (MOL.EQ.)	0.03534692
ANIONS (MOL.EQ.)	0.02961237
DIFFERENCE (%)	17.66

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	73.71	CO2	1732.00	CO2	0.355E+00
NA	224.50	H2S	0.10	H2S	0.207E-04
K	27.90	H2	0.00	H2	0.000E+00
CA	277.90	O2	0.00	O2	0.000E+00
MG	159.687	CH4	0.00	CH4	0.000E+00
SO4	104.20	N2	0.00	N2	0.000E+00
CL	150.99	NH3	0.00	NH3	0.000E+00
F	0.44			H2O	0.297E-01
DISS.S.	0.00			TOTAL	0.385E+00
AL	0.0000				
B	0.2400	H2O (%)	0.00		
FE	0.0000	BOILING PORTION	0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

HI	0.855	KS04-	0.831	FE++	0.494	FECL1	0.820
OH-	0.815	F-	0.815	FE+++	0.252	AL+++	0.252
H3SI04-	0.820	CL-	0.811	FE0H	0.828	ALOH++	0.483
H2SI04--	0.483	NA+	0.820	FE(OH)3-	0.828	AL(OH)2+	0.831
H2BO3-	0.806	K+	0.811	FE(OH)4--	0.476	AL(OH)4-	0.824
HCO3-	0.820	CA++	0.494	FE0H+	0.476	ALSO4+	0.824
CO3---	0.467	MG++	0.526	FE(OH)2+	0.831	AL(SO4)2-	0.824
HS-	0.815	CAHCO3+	0.836	FE(OH)4-	0.831	ALF++	0.483
S--	0.476	MGHCO3+	0.820	FES04+	0.828	ALF2+	0.831
HSO4-	0.824	CAOH+	0.836	FECL++	0.476	ALF4-	0.824
SO4---	0.458	MGOH+	0.839	FECL2+	0.828	ALF5---	0.467
NASO4-	0.831	NH4+	0.806	FECL4-	0.820	ALF6---	0.181

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

HI (ACT.)	0.00	-6.535	MG++	135.22	-2.255	FE(OH)3	0.00	0.000
OH-	0.00	-7.399	NACL	0.04	-6.128	FE(OH)4-	0.00	0.000
H4SI04	117.84	-2.912	KCL	0.00	-7.241	FECL+	0.00	0.000
H3SI04-	0.06	-6.224	NASO4-	0.68	-5.242	FECL2	0.00	0.000
H2SI04--	0.00	-11.206	KS04-	0.23	-5.775	FECL++	0.00	0.000
NAH3SI04-	0.01	-7.260	CASO4	15.43	-3.946	FECL2+	0.00	0.000
H3BO3	1.37	-4.655	MGS04	22.66	-3.725	FECL3	0.00	0.000
H2BO3-	0.00	-7.304	CACO3	1.19	-4.926	FECL4-	0.00	0.000
H2CO3	873.25	-1.851	MGCO3	0.68	-5.094	FES04	0.00	0.000
HCO3-	1447.95	-1.625	CAHCO3+	71.94	-3.148	FES04+	0.00	0.000
CO3---	0.37	-5.205	MGHCO3+	69.11	-3.092	AL+++	0.00	0.000
H2S	0.07	-5.667	CAOH+	0.00	-8.716	ALOH++	0.00	0.000
HS-	0.03	-6.106	MGOH+	0.00	-7.751	AL(OH)2+	0.00	0.000
S--	0.00	-16.425	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.516	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-7.913	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4---	74.52	-3.110	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.087	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.44	-4.635	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	150.96	-2.371	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	224.35	-2.011	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	27.83	-3.148	FE(OH)++	0.00	0.000	ALF5---	0.00	0.000
CA++	244.36	-2.215	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.04488

IONIC BALANCE :

CATIONS (MOL.EQ.)	0.03531071
ANIONS (MOL.EQ.)	0.02957606
DIFFERENCE (%)	17.68

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.37

QUARTZ	120.9
CHALCEDONY	91.2
NAK	222.2

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.164 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-21.263	99.999	ALBITE LOW	-20.147	99.999	ANALCINE	-16.001	99.999
ANHYDRITE	-4.701	-5.971	CALCITE	-8.423	-8.056	CHALCEDONY	-3.561	-2.912
MG-CHLORITE	-85.139	99.999	FLUORITE	-10.951	-11.969	GOETHITE	-9.073	99.999
LAUMONDITE	-32.274	99.999	MICROCLINE	-23.283	99.999	MAGNETITE	-33.862	99.999
CA-MONTHOR.	-110.023	99.999	K-MONTHOR.	-55.259	99.999	MG-MONTHOR.	-110.666	99.999
NA-MONTHOR.	-54.512	99.999	MUSCOVITE	-27.244	99.999	PREHNITE	-41.080	99.999
PYRRHOTITE	2.065	99.999	PYRITE	-54.471	99.999	QUARTZ	-4.005	-2.912
WAIRAKITE	-27.843	99.999	WOLLASTONITE	13.087	7.637	ZOISITE	-39.580	99.999
EPIDOTE	-149.999	99.999						

ORKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

7909270012

SOURCE DES NOCAIS D'IFANJA, MIARINARIVO-ITASY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE	
PH/DEG.C	6.98/23.0	GAS (VOL.Z)	REFERENCE TEMP. DEGREES C 46.0 (MEASURED)
SI02	107.00	CO2	
NA	351.50	H2S	SAMPLING PRESSURE BARS ABS.
K	22.50	H2	DISCHARGE ENTHALPY MJ/OL/KG
CA	208.50	O2	DISCHARGE KG/SEC. 0.0
HG	202.200	CH4	
CO2	1152.00	N2	MEASURED TEMPERATURE DEGREES C 46.0
SO4	940.10		RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
H2S	0.15		EH/TEMP. MV/DEG.C 0.000/ 0.0
CL	77.50		
F	1.77	LITERS GAS PER 'KG	MEASURED DOWNHOLE TEMP. DEGREES C/METERS
DISS.SOLIDS	0.00	CONDENSATE/DEG.C /	FLUID INFLOW DEPTH (METERS)
AL	0.0000		
B	0.0600	CONDENSATE (PPM)	
FE	0.0000	PH/DEG.C /	
NH3	0.0000	CO2	0.0
*		H2S	0.0
*		NA	0.0
*			0.0
			0.0
			0.0
		CONDENSATE WITH NAOH (PPM)	0.0
		CO2	0.0
		H2S	0.0

IONIC STRENGTH = 0.05489

IONIC BALANCE : CATIONS (MOL.EQ.)0.03703453
ANIONS (MOL.EQ.)0.03775740
DIFFERENCE (%) -1.93

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	107.01	CO2	1152.00	CO2	0.194E+00
NA	351.50	H2S	0.15	H2S	0.292E-04
K	22.50	H2	0.00	H2	0.000E+00
CA	208.50	O2	0.00	O2	0.000E+00
HG	202.183	CH4	0.00	CH4	0.000E+00
SO4	940.08	N2	0.00	N2	0.000E+00
CL	77.49	NH3	0.00	NH3	0.000E+00
F	1.77			H2O	0.101E+00
DISS.S.	0.00			TOTAL	0.294E+00
AL	0.0000				
B	0.0600	H2O (%)	0.00		
FE	0.0000	BOILING PORTION	0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

HI	0.845	KS04-	0.819	FE++	0.468	FECL1	0.806
OH-	0.801	F-	0.801	FE+++	0.229	AL+++	0.229
H3SI04-	0.806	CL-	0.796	FE0H+	0.816	AL0H+	0.457
H2SI04-	0.457	NA+	0.806	FE(OH)3-	0.816	AL(OH)2+	0.819
H2B03-	0.790	K+	0.796	FE(OH)4---	0.449	AL(OH)4-	0.811
HCO3-	0.806	CA++	0.468	FE0H++	0.449	ALSO4+	0.811
CO3--	0.439	MG++	0.502	FE(OH)2+	0.819	AL(SO4)2-	0.811
HS-	0.801	CAHCO3+	0.824	FE(OH)4-	0.819	ALF++	0.457
S---	0.449	MGHCO3+	0.806	FES04+	0.816	ALF2+	0.819
HSO4-	0.811	CAOH+	0.824	FECL1+	0.449	ALF4-	0.811
SO4--	0.429	MGOH+	0.828	FECL2+	0.816	ALF5---	0.439
NASO4-	0.819	NH4+	0.790	FECL4-	0.806	ALF6---	0.150

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

HF (ACT.)	0.00	-6.897	MG++	125.78	-2.286	FE(OH)3	0.00	0.000
OH-	0.01	-6.377	NACL	0.06	-5.983	FE(OH)4	0.00	0.000
H4SI04	170.64	-2.751	KCL	0.00	-7.515	FECL1	0.00	0.000
H3SI04-	0.47	-5.311	NASO4-	11.10	-4.031	FECL2	0.00	0.000
H2SI04--	0.00	-9.584	KS04-	1.96	-4.839	FECL1+	0.00	0.000
NAH3SI04-	0.08	-6.195	CASO4	94.36	-3.159	FECL2+	0.00	0.000
H3B03	0.34	-5.259	HCSO4	288.64	-2.620	FECL3	0.00	0.000
H2B03-	0.00	-7.387	CACO3	3.24	-4.490	FECL4-	0.00	0.000
H2CO3	272.92	-2.357	MGO3	2.18	-4.587	FES04	0.00	0.000
HCO3-	1238.44	-1.693	CAHCO3+	69.24	-3.164	FES04+	0.00	0.000
CO3--	1.10	-4.738	MGHCO3+	61.35	-3.143	AL+++	0.00	0.000
H2S	0.06	-5.742	CAOH+	0.00	-7.828	AL0H+	0.00	0.000
HS-	0.09	-5.587	MGOH+	0.01	-6.655	AL(OH)2+	0.00	0.000
S---	0.00	-15.184	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-16.710	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.01	-7.095	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	632.80	-2.181	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.674	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	1.77	-4.031	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	77.46	-2.661	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	349.32	-1.818	FE(OH)4---	0.00	0.000	ALF4-	0.00	0.000
K+	21.93	-3.251	FE(OH)1+	0.00	0.000	ALF5---	0.00	0.000
CA++	151.97	-2.421	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.05101

IONIC BALANCE : CATIONS (MOL.EQ.)0.03509038
ANIONS (MOL.EQ.)0.03579320
DIFFERENCE (%) -1.98

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.13

QUARTZ	141.0
CHALCEDONY	111.7
NAK	153.5

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.223 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-19.811	99.999	ALBITE LOW	-18.027	99.999	ANALCIME	-14.977	99.999
ANHYDRITE	-4.923	-5.300	CALCITE	-8.618	-7.847	CHALCEDONY	-3.326	-2.751
MG-CHLORITE	-83.012	99.999	FLUORITE	-10.744	-11.005	GOETHITE	-8.150	99.999
LAUMONDITE	-30.425	99.999	MICROCLINE	-21.616	99.999	MAGNETITE	-32.099	99.999
CA-MONTHOR.	-101.561	99.999	K-MONTHOR.	-50.645	99.999	MG-MONTHOR.	-102.379	99.999
NA-MONTHOR.	-50.070	99.999	MUSCOVITE	-25.122	99.999	PREHNITE	-39.385	99.999
PYRRHOTITE	1.770	99.999	PYRITE	-50.724	99.999	QUARTZ	-3.687	-2.751
WAIKAKITE	-26.640	99.999	WOLLASTONITE	12.132	8.292	ZOISITE	-38.118	99.999
EPIDOTE	-146.124	99.999						

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

7909300014

ANDRANOMAFANA DE BETSIAKA, AMBILOBE, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

PH/DEG.C	7.45/32.0
SI02	106.10
NA	396.20
K	21.00
CA	48.30
MG	4.700
CO2	293.00
SO4	422.80
H2S	0.14
CL	185.00
F	3.95
DISS.SOLIDS	0.00
AL	0.0000
B	0.2200
FE	0.0000
NH3	0.0000
*	
*	
*	

STEAM SAMPLE

GAS (VOL.%)	
CO2	
H2S	
H2	
O2	
CH4	
N2	
LITERS GAS PER 'KG CONDENSATE/DEG.C	
CONDENSATE (PPM)	
PH/DEG.C	
CO2	
H2S	
NA	
CONDENSATE WITH NaOH (PPM)	
CO2	
H2S	

REFERENCE TEMP. DEGREES C 78.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/OL/KG
DISCHARGE KG/SEC. 0.0

MEASURED TEMPERATURE DEGREES C 78.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0

IONIC STRENGTH = 0.02527

IONIC BALANCE : CATIONS (MOL.EQ.)0.02004252
ANIONS (MOL.EQ.)0.01989058
DIFFERENCE (%) 0.76

DEEP WATER (PPM)

SI02	106.11
NA	396.20
K	21.00
CA	48.30
MG	4.700
SO4	422.79
CL	184.98
F	3.95
DISS.S.	0.00
AL	0.0000
B	0.2200
FE	0.0000

DEEP STEAM (PPM)

CO2	293.00
H2S	0.14
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.372E-01
H2S	0.156E-04
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.436E+00
TOTAL	0.474E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.869	KSO4-	0.852	FE++	0.538	FECL+	0.844
OH-	0.840	F-	0.840	FE+++	0.289	AL+++	0.289
H3SI04-	0.844	CL-	0.837	FE0H+	0.849	ALOH++	0.530
H2SI04--	0.530	NA+	0.844	FE(OH)3-	0.849	AL(OH)2+	0.852
H2BO3-	0.834	K+	0.837	FE(OH)4--	0.525	AL(OH)4-	0.847
HCO3-	0.844	CA++	0.538	FE0H++	0.525	ALSO4+	0.847
CO3--	0.517	MG++	0.564	FE(OH)2+	0.852	AL(SO4)2-	0.847
HS-	0.840	CAHCO3+	0.855	FE(OH)4-	0.852	ALF++	0.530
S--	0.525	MGHCO3+	0.844	FES04+	0.849	ALF2+	0.852
HSO4-	0.847	CAOH+	0.855	FECL++	0.525	ALF4-	0.847
SO4--	0.510	MGOH+	0.858	FECL2+	0.849	ALF5--	0.517
NASO4-	0.852	NH4+	0.834	FECL4-	0.844	ALF6---	0.228

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.361	MG++	2.49	-3.989	FE(OH)3	0.00	0.000
OH-	0.11	-5.207	NACL	0.47	-5.093	FE(OH)4-	0.00	0.000
H4SI04	166.06	-2.763	KCL	0.01	-6.923	FECL+	0.00	0.000
H3SI04-	3.15	-4.480	NASO4-	13.44	-3.947	FECL2	0.00	0.000
H2SI04--	0.00	-8.027	KSO4-	2.08	-4.813	FECL++	0.00	0.000
NAH3SI04-	0.60	-5.293	CASO4	28.00	-3.687	FECL2+	0.00	0.000
H3BO3	1.22	-4.703	MGSO4	10.06	-4.078	FECL3	0.00	0.000
H2BO3-	0.03	-6.255	CACO3	2.12	-4.673	FECL4-	0.00	0.000
H2CO3	29.77	-3.319	MGC03	0.09	-5.992	FES04	0.00	0.000
HCO3-	366.46	-2.221	CAHCO3+	12.81	-3.897	FES04+	0.00	0.000
CO3--	1.03	-4.767	MGHCO3+	0.52	-5.215	AL+++	0.00	0.000
H2S	0.02	-6.243	CAOH+	0.00	-7.088	ALOH++	0.00	0.000
HS-	0.12	-5.451	MGOH+	0.00	-6.974	AL(OH)2+	0.00	0.000
S--	0.00	-14.212	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-16.915	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-7.298	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	382.69	-2.400	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.487	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	3.95	-3.682	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	184.69	-2.283	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	393.30	-1.767	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	20.39	-3.283	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	34.13	-3.070	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.02452

IONIC BALANCE : CATIONS (MOL.EQ.)0.01967013
ANIONS (MOL.EQ.)0.01946873
DIFFERENCE (%) 1.03

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.85

QUARTZ	139.5
CHALCEDONY	110.1
NAK	137.9

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.316 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-18.050	99.999	ALBITE LOW	-17.223	99.999	ANALCINE	-13.697	99.999
ANHYDRITE	-5.308	-6.031	CALCITE	-9.001	-8.392	CHALCEDONY	-3.030	-2.763
MG-CHLORITE	-80.813	99.999	FLUORITE	-10.582	-10.854	GOETHITE	-6.865	99.999
LAUMONDITE	-28.156	99.999	MICROCLINE	-19.588	99.999	MAGNETITE	-29.663	99.999
CA-MONTHOR.	-90.396	99.999	K-MONTHOR.	-44.615	99.999	MG-MONTHOR.	-91.354	99.999
NA-MONTHOR.	-44.241	99.999	MUSCOVITE	-22.405	99.999	PREHNITE	-37.487	99.999
PYRRHOTITE	1.435	99.999	PYRITE	-45.963	99.999	QUARTZ	-3.298	-2.763
WATRAKITE	-25.184	99.999	WOLLASTONITE	10.964	8.620	ZOISITE	-36.468	99.999
EPIDOTE	-142.133	99.999						

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

7910010016

ANDRANOMAFANA MIGOIKY, AMBANJA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE		REFERENCE TEMP.		DEGREES C		72.0 (MEASURED)	
PH/DEG.C	7.35/31.0	GAS (VOL.%)		SAMPLING PRESSURE	BARS ABS.				
SI02	97.20	CO2		DISCHARGE ENTHALPY	MJ/OL/KG				
NA	694.30	H2S		DISCHARGE	KG/SEC.		0.0		
K	77.50	H2		MEASURED TEMPERATURE	DEGREES C		72.0		
CA	97.70	O2		RESISTIVITY/TEMP.	OHM/DEG.C		0.0/ 0.0		
MG	32.300	CH4		EH/TEMP.	MV/DEG.C		0.000/ 0.0		
CO2	1389.00	N2							
SO4	98.40								
H2S	0.14								
CL	282.50								
F	2.00								
DISS.SOLIDS	0.00	LITERS GAS PER 'KG CONDENSATE/DEG.C		MEASURED DOWNHOLE TEMP.	DEGREES C/METERS			FLUID INFLOW DEPTH (METERS)	
AL	0.0000								
B	0.4000								
FE	0.0000	CONDENSATE (PPM)							
NH3	0.0000	PH/DEG.C							
*		CO2							
*		H2S							
*		NA							
		CONDENSATE WITH NaOH (PPM)							
		CO2							
		H2S							

IONIC STRENGTH = 0.04266 IONIC BALANCE : CATIONS (MOL.EQ.) 0.03882248
ANIONS (MOL.EQ.) 0.03846321
DIFFERENCE (%) 0.93

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	97.21	CO2	1389.00	CO2	0.182E+00
NA	694.30	H2S	0.14	H2S	0.173E-04
K	77.50	H2	0.00	H2	0.000E+00
CA	97.70	O2	0.00	O2	0.000E+00
MG	32.297	CH4	0.00	CH4	0.000E+00
SO4	98.40	N2	0.00	N2	0.000E+00
CL	282.48	NH3	0.00	NH3	0.000E+00
F	2.00			H2O	0.339E+00
DISS.S.	0.00			TOTAL	0.521E+00
AL	0.0000				
B	0.4000				
FE	0.0000				

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.848	KS04-	0.824	FE++	0.477	FECL+	0.812
OH-	0.808	F-	0.808	FE+++	0.235	AL+++	0.235
H3SI04-	0.812	CL-	0.803	FE0H+	0.821	AL0H++	0.467
H2SI04--	0.467	NA+	0.812	FE(OH)3-	0.821	AL(OH)2+	0.824
H2B03-	0.798	K+	0.803	FE(OH)4--	0.460	AL(OH)4-	0.817
HCO3-	0.812	CA++	0.477	FE0H++	0.460	ALSO4+	0.817
CO3--	0.450	MG++	0.509	FE(OH)2+	0.824	AL(SO4)2-	0.817
HS-	0.808	CAHCO3+	0.829	FE(OH)4-	0.824	ALF++	0.467
S--	0.460	MGHCO3+	0.812	FES04+	0.821	ALF2+	0.824
HS04-	0.817	CAOH+	0.829	FECL++	0.460	ALF4-	0.817
SO4--	0.441	MGOH+	0.832	FECL2+	0.821	ALF5--	0.450
NAS04-	0.824	NH4+	0.798	FECL4-	0.812	ALF6---	0.167

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.276	MG++	23.39	-3.017	FE(OH)3	0.00	0.000
OH-	0.07	-5.394	NACL	0.99	-4.772	FE(OH)4-	0.00	0.000
H4SI04	152.78	-2.799	KCL	0.04	-6.236	FECL+	0.00	0.000
H3SI04-	2.15	-4.647	NAS04-	3.89	-4.485	FECL2	0.00	0.000
H2SI04--	0.00	-8.283	KS04-	1.28	-5.025	FECL++	0.00	0.000
NAH3SI04-	0.67	-5.244	CAS04	7.10	-4.283	FECL2+	0.00	0.000
H3B03	2.24	-4.442	MGS04	13.20	-3.960	FECL3	0.00	0.000
H2B03-	0.05	-6.078	CAC03	10.22	-3.991	FECL4-	0.00	0.000
H2CO3	157.47	-2.595	MGC03	2.40	-4.546	FES04	0.00	0.000
HCO3-	1697.21	-1.556	CAHCO3+	78.77	-3.108	FES04+	0.00	0.000
CO3--	4.26	-4.148	MGHCO3+	19.42	-3.643	AL+++	0.00	0.000
H2S	0.02	-6.165	CAOH+	0.00	-7.113	AL0H++	0.00	0.000
HS-	0.11	-5.466	MGOH+	0.02	-6.266	AL(OH)2+	0.00	0.000
S--	0.00	-14.344	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.654	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HS04-	0.00	-8.029	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	78.80	-3.086	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.769	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	2.00	-3.978	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	281.86	-2.100	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	693.03	-1.521	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	77.10	-2.705	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	60.28	-2.823	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.04123 IONIC BALANCE : CATIONS (MOL.EQ.) 0.03805687
ANIONS (MOL.EQ.) 0.03768378
DIFFERENCE (%) 0.99

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	134.8
CHALCEDONY	105.4
NAK	209.8

1000/T DEGREES KELVIN = 2.90

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.305 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-18.357	99.999	ALBITE LOW	-17.504	99.999	ANALCIME	-13.922	99.999
ANHYDRITE	-5.230	-6.586	CALCITE	-8.921	-7.639	CHALCEDONY	-3.082	-2.799
MG-CHLORITE	-81.156	99.999	FLUORITE	-10.602	-11.285	GOETHITE	-7.104	99.999
LAUMONDITE	-28.556	99.999	MICROCLINE	-19.941	99.999	MAGNETITE	-30.114	99.999
CA-MONTMOR.	-92.436	99.999	K-MONTMOR.	-45.709	99.999	MG-MONTMOR.	-93.379	99.999
NA-MONTMOR.	-45.302	99.999	MUSCOVITE	-22.893	99.999	PREHNITE	-37.809	99.999
PYRRHOTITE	1.490	99.999	PYRITE	-46.797	99.999	QUARTZ	-3.364	-2.799
WAIKAKITE	-25.441	99.999	WOLLASTONITE	11.166	8.609	ZOISITE	-36.754	99.999
EPIDOTE	-142.750	99.999						

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

7910260017

SOURCE ANDRANOMAFANA D'ANKAZOHELY, ANTSIRANANA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	8.10/28.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	55.0 (MEASURED)
SI02	66.90	CO2	SAMPLING PRESSURE	BARS ABS.	
NA	123.80	H2S	DISCHARGE ENTHALPY	MJ/OL/KG	
K	4.10	H2	DISCHARGE	KG/SEC.	3.0
CA	15.50	O2	MEASURED TEMPERATURE	DEGREES C	55.0
MG	2.900	CH4	RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
CO2	186.00	N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0
SO4	58.90				
H2S	0.00				
CL	21.40				
F	4.02	LITERS GAS PER 'KG	MEASURED DOWNHOLE TEMP.	DEGREES C/METERS	FLUID INFLOW
DISS.SOLIDS	0.00	CONDENSATE/DEG.C			DEPTH (METERS)
AL	0.0000				
B	0.0300	CONDENSATE (PPM)	0.0	0.0	0.0
FE	0.0000	PH/DEG.C	0.0	0.0	0.0
NH3	0.0000	CO2	0.0	0.0	0.0
H2S	<0.1	H2S	0.0	0.0	0.0
*		NA	0.0	0.0	0.0
*			0.0	0.0	0.0
			0.0	0.0	0.0
			0.0	0.0	0.0
		CONDENSATE WITH NaOH (PPM)	0.0	0.0	0.0
		CO2	0.0	0.0	0.0
		H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.00739

IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.00642505
 ANIONS (MOL.EQ.) 0.00618230
 DIFFERENCE (%) 3.85

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	66.91	CO2	186.00	CO2	0.00	CO2	0.502E-02
NA	123.80	H2S	0.00	H2S	0.00	H2S	0.000E+00
K	4.10	H2	0.00	H2	0.00	H2	0.000E+00
CA	15.50	O2	0.00	O2	0.00	O2	0.000E+00
MG	2.900	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	58.90	N2	0.00	N2	0.00	N2	0.000E+00
CL	21.40	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	4.02					H2O	0.157E+00
DISS.S.	0.00					TOTAL	0.162E+00
AL	0.0000					H2O (%)	0.00
B	0.0300					BOILING PORTION	0.00
FE	0.0000						

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.919	KSO4-	0.912	FE++	0.698	FECL+	0.909
OH-	0.908	F-	0.908	FE+++	0.471	AL+++	0.471
H3SI04-	0.909	CL-	0.907	FE(OH)+	0.911	AL(OH)++	0.694
H2SI04--	0.694	NA+	0.909	FE(OH)3-	0.911	AL(OH)2+	0.912
H2BO3-	0.906	K+	0.907	FE(OH)4--	0.692	AL(OH)4-	0.910
HCO3-	0.909	CA++	0.698	FE(OH)2+	0.912	ALSO4+	0.910
CO3--	0.688	MG++	0.710	FE(OH)4-	0.912	AL(SO4)2-	0.910
HS-	0.908	CAHCO3+	0.913	FE(OH)4-	0.912	ALF++	0.694
S--	0.692	MGHCO3+	0.909	FES04+	0.911	ALF2+	0.910
HSO4-	0.910	CAOH+	0.913	FECL++	0.692	ALF4-	0.910
SO4--	0.685	MGOH+	0.914	FECL2+	0.911	ALF5--	0.688
NASO4-	0.912	NH4+	0.906	FECL4-	0.909	ALF6---	0.432

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.908	MG++	2.46	-3.995	FE(OH)3	0.00	0.000
OH-	0.11	-5.192	NACL	0.01	-6.763	FE(OH)4-	0.00	0.000
H4SI04	103.33	-2.969	KCL	0.00	-8.634	FECL+	0.00	0.000
H3SI04-	3.45	-4.440	NASO4-	0.63	-5.279	FECL2	0.00	0.000
H2SI04--	0.00	-7.726	KSO4-	0.06	-6.354	FECL++	0.00	0.000
NAH3SI04-	0.25	-5.679	CASO4	1.98	-4.837	FECL2+	0.00	0.000
H3BO3	0.16	-5.588	MGSO4	1.41	-4.931	FECL3	0.00	0.000
H2BO3-	0.01	-6.717	CACO3	1.36	-4.868	FECL4-	0.00	0.000
H2CO3	5.88	-4.023	MGCO3	0.17	-5.688	FES04	0.00	0.000
HCO3-	247.65	-2.392	CAHCO3+	2.39	-4.626	FES04+	0.00	0.000
CO3--	1.77	-4.530	MGHCO3+	0.36	-5.372	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-7.472	ALOH++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-6.972	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-19.335	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.892	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	55.83	-3.236	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.198	FE(OH)+	0.00	0.000	ALF++	0.00	0.000
F-	4.02	-3.674	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	21.39	-3.219	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	123.63	-2.269	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	4.08	-3.981	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	13.42	-3.475	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00731

IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.00638204
 ANIONS (MOL.EQ.) 0.00613786
 DIFFERENCE (%) 3.90

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.05

QUARTZ	114.3
CHALCEDONY	84.5
NAK	104.6

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-19.282	99.999	ALBITE LOW	-18.346	99.999	ANALCIME	-14.596	99.999
ANHYDRITE	-5.024	-7.031	CALCITE	-8.715	-8.323	CHALCEDONY	-3.237	-2.969
MG-CHLORITE	-82.297	99.999	FLUORITE	-10.684	-11.064	GOETHITE	-7.785	99.999
LAUMONDITE	-29.749	99.999	MICROCLINE	-21.007	99.999	MAGNETITE	-31.404	99.999
CA-MONTHOR.	-98.330	99.999	K-MONTHOR.	-48.892	99.999	MG-MONTHOR.	-99.203	99.999
NA-MONTHOR.	-48.379	99.999	MUSCOVITE	-24.326	99.999	PREHNITE	-38.799	99.999
PYRRHOTITE	1.666	99.999	PYRITE	-49.306	99.999	QUARTZ	-3.569	-2.969
WATRAKITE	-26.206	99.999	WOLLASTONITE	11.780	9.216	ZOISITE	-37.615	99.999
EPIDOTE	-144.820	99.999						

ORKUSTOFNUN JHD
1980-11-14 HORDUR

MADAGASCAR

7910290018 SOURCE ANDRANONAFANA DE MAEVADOANY, ANTRIRANANA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE		REFERENCE TEMP.		DEGREES C		46.0 (MEASURED)	
PH/DEG.C	7.38/20.0	GAS (VOL.%)		SAMPLING PRESSURE	BARS ABS.			DISCHARGE ENTHALPY	MJ/OL/KG
SI02	84.10	CO2		DISCHARGE	KG/SEC.		0.5		
NA	244.40	H2S		MEASURED TEMPERATURE	DEGREES C		46.0		
K	13.10	H2		RESISTIVITY/TEMP.	OHM/DEG.C		0.0/ 0.0		
CA	38.30	O2		EH/TEMP.	MV/DEG.C		0.000/ 0.0		
MG	8.300	CH4							
CO2	351.00	N2							
SO4	175.00								
H2S	0.00								
CL	56.20								
F	4.01	LITERS GAS PER 'KG							
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	/	MEASURED DOWNHOLE TEMP.	DEGREES C/METERS			FLUID INFLOW	DEPTH (METERS)
AL	0.0000								
B	0.0800	CONDENSATE (PPM)							
FE	0.0000	PH/DEG.C	/						
NH3	0.0000	CO2							
H2S	<0.1	H2S							
*		NA							
*									
		CONDENSATE WITH NaOH (PPM)							
		CO2							
		H2S							

IONIC STRENGTH = 0.01576 IONIC BALANCE : CATIONS (MOL.EQ.)0.01330329
ANIONS (MOL.EQ.)0.01247005
DIFFERENCE (%) 6.47

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	84.11	CO2	351.00	CO2	0.309E-01
NA	244.40	H2S	0.00	H2S	0.000E+00
K	13.10	H2	0.00	H2	0.000E+00
CA	38.30	O2	0.00	O2	0.000E+00
MG	8.299	CH4	0.00	CH4	0.000E+00
SO4	175.00	N2	0.00	N2	0.000E+00
CL	56.20	NH3	0.00	NH3	0.000E+00
F	4.01			H2O	0.101E+00
DISS.S.	0.00			TOTAL	0.132E+00
AL	0.0000				
B	0.0800	H2O (%)	0.00		
FE	0.0000	BOILING PORTION	0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.895	KSO4-	0.883	FE++	0.616	FECL+	0.877
OH-	0.875	F-	0.875	FE+++	0.372	AL+++	0.372
H3SI04-	0.877	CL-	0.873	FE0H+	0.881	ALOH+	0.610
H2SI04--	0.610	NA+	0.877	FE(OH)3-	0.881	AL(OH)2+	0.883
H2BO3-	0.871	K+	0.873	FE(OH)4---	0.606	AL(OH)4-	0.879
HCO3-	0.877	CA++	0.616	FE0H++	0.606	ALSO4+	0.879
CO3--	0.601	MG++	0.635	FE(OH)2+	0.883	AL(SO4)2-	0.879
HS-	0.875	CANCO3+	0.885	FE(OH)4-	0.883	ALF++	0.610
S--	0.606	MGHCO3+	0.877	FES04+	0.881	ALF2+	0.883
H2SO4-	0.879	CAOH+	0.885	FECL++	0.606	ALF4-	0.879
SO4--	0.595	MGOH+	0.887	FECL2+	0.881	ALF5--	0.601
NASO4-	0.883	NH4+	0.871	FECL4-	0.877	ALF6---	0.318

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.279	MG++	6.51	-3.572	FE(OH)3	0.00	0.000
OH-	0.02	-6.034	NACL	0.04	-6.202	FE(OH)4-	0.00	0.000
H4SI04	133.64	-2.857	KCL	0.00	-7.802	FECL+	0.00	0.000
H3SI04-	0.81	-5.072	NASO4-	2.76	-4.635	FECL2	0.00	0.000
H2SI04--	0.00	-9.052	KSO4-	0.42	-5.512	FECL++	0.00	0.000
NAH3SI04-	0.11	-6.039	CASO4	9.35	-4.163	FECL2+	0.00	0.000
H3BO3	0.45	-5.138	MGS04	6.66	-4.257	FECL3	0.00	0.000
H2BO3-	0.01	-6.927	CACO3	0.84	-5.074	FECL4-	0.00	0.000
H2CO3	43.54	-3.154	HGCO3	0.13	-5.805	FES04	0.00	0.000
HCO3-	437.25	-2.145	CANCO3+	6.97	-4.162	FES04+	0.00	0.000
CO3--	0.74	-4.908	MGHCO3+	1.42	-4.779	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-8.028	ALOH+	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-7.488	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.927	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
H2SO4-	0.00	-7.965	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	160.57	-2.777	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.662	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	4.01	-3.676	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	56.17	-2.800	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	243.83	-1.974	FE(OH)4---	0.00	0.000	ALF4-	0.00	0.000
K+	12.98	-3.479	FE(OH)4+	0.00	0.000	ALF5--	0.00	0.000
CA++	32.45	-3.092	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01552 IONIC BALANCE : CATIONS (MOL.EQ.)0.01317838
ANIONS (MOL.EQ.)0.01233851
DIFFERENCE (%) 6.58

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.13

QUARTZ	127.5
CHALCEDONY	97.9
NAK	140.2

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-19.811	99.999	ALBITE LOW	-18.827	99.999	ANALCINE	-14.977	99.999
ANHYDRITE	-4.923	-6.304	CALCITE	-8.618	-8.431	CHALCEDONY	-3.326	-2.857
MG-CHLORITE	-83.012	99.999	FLUORITE	-10.744	-10.769	GOETHITE	-8.150	99.999
LAUMONDITE	-30.425	99.999	MICROCLINE	-21.616	99.999	MAGNETITE	-32.099	99.999
CA-MONTHOR.	-101.561	99.999	K-MONTHOR.	-50.645	99.999	MG-MONTHOR.	-102.379	99.999
NA-MONTHOR.	-50.070	99.999	MUSCOVITE	-25.122	99.999	PREHNITE	-39.385	99.999
PYRRHOTITE	1.770	99.999	PYRITE	-50.724	99.999	QUARTZ	-3.687	-2.857
WAIRAKITE	-26.640	99.999	WOLLASTONITE	12.132	8.399	ZOISITE	-38.118	99.999
EPIDOTE	-146.124	99.999						

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

7911030021

SOURCE D'ANDRANOMANDEVY, ANTIRANANA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	6.78/27.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	29.0 (MEASURED)
SI02	25.60	CO2	SAMPLING PRESSURE	BARS ABS.	
NA	163.60	H2S	DISCHARGE ENTHALPY	MJ/OL/KG	
K	18.60	H2	DISCHARGE	KG/SEC.	0.5
CA	338.50	O2	MEASURED TEMPERATURE	DEGREES C	29.0
MG	35.700	CH4	RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0
CO2	1115.80	N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0
SO4	123.20		MEASURED DOWNHOLE TEMP.	DEGREES C/METERS	
H2S	0.00		FLUID INFLOW	DEPTH (METERS)	
CL	140.30				
F	0.41	LITERS GAS PER 'KG			
DISS. SOLIDS	0.00	CONDENSATE/DEG.C			
AL	0.0000				
B	0.2500	CONDENSATE (PPM)			
FE	0.0000	PH/DEG.C			
NH3	0.0000	CO2			
H2S	<0.1	H2S			
*		NA			
*					
		CONDENSATE WITH NAOH (PPM)			
		CO2			
		H2S			

IONIC STRENGTH = 0.03477

IONIC BALANCE :

CATIONS (MOL.EQ.)	0.02587581
ANIONS (MOL.EQ.)	0.02428494
DIFFERENCE (%)	6.34

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	25.60	CO2	1115.80	CO2	0.00	CO2	0.178E+00
NA	163.60	H2S	0.00	H2S	0.00	H2S	0.000E+00
K	18.60	H2	0.00	H2	0.00	H2	0.000E+00
CA	338.50	O2	0.00	O2	0.00	O2	0.000E+00
MG	35.697	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	123.20	N2	0.00	N2	0.00	N2	0.000E+00
CL	140.29	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	0.41					H2O	0.399E-01
DISS.S.	0.00					TOTAL	0.218E+00
AL	0.0000						
B	0.2500					H2O (%)	0.00
FE	0.0000					BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.865	KSO4-	0.845	FE++	0.525	FECL+	0.836
OH-	0.832	F-	0.832	FE+++	0.279	AL+++	0.279
H3SI04-	0.836	CL-	0.828	FE0H+	0.843	AL0H++	0.515
H2SI04--	0.515	NA+	0.836	FE(OH)3-	0.843	AL(OH)2+	0.845
H2BO3-	0.824	K+	0.828	FE(OH)4--	0.509	AL(OH)4-	0.839
HCO3-	0.836	CA++	0.525	FE0H++	0.509	ALSO4+	0.839
CO3--	0.501	MG++	0.553	FE(OH)2+	0.845	AL(SO4)2-	0.839
HS-	0.832	CAHCO3+	0.849	FE(OH)4-	0.845	ALF++	0.515
S--	0.509	MGHCO3+	0.836	FESO4+	0.843	ALF2+	0.845
H2SO4-	0.839	CAOH+	0.849	FECL++	0.509	ALF4-	0.839
SO4--	0.492	MGOH+	0.852	FECL2+	0.843	ALF5--	0.501
NASO4-	0.845	NH4+	0.824	FECL4-	0.836	ALF6---	0.212

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-6.771	MG++	30.24	-2.905	FE(OH)3	0.00	0.000
OH-	0.00	-7.011	NACL	0.03	-6.231	FE(OH)4-	0.00	0.000
H4SI04	40.91	-3.371	KCL	0.00	-7.401	FECL+	0.00	0.000
H3SI04-	0.04	-6.360	NASO4-	0.73	-5.212	FECL2	0.00	0.000
H2SI04--	0.00	-11.041	KSO4-	0.23	-5.778	FECL++	0.00	0.000
NAH3SI04-	0.00	-7.524	CASO4	28.90	-3.673	FECL2+	0.00	0.000
H3BO3	1.42	-4.638	MGSO4	8.42	-4.155	FECL3	0.00	0.000
H2BO3-	0.01	-7.022	CACO3	2.55	-4.594	FECL4-	0.00	0.000
H2CO3	378.29	-2.215	MGO3	0.25	-5.525	FESO4	0.00	0.000
HCO3-	1113.28	-1.739	CAHCO3+	83.08	-3.085	FESO4+	0.00	0.000
CO3--	0.52	-5.063	MGHCO3+	12.93	-3.820	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-8.195	AL0H++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-7.958	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.703	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
H2SO4-	0.00	-7.957	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	95.34	-3.003	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.306	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.41	-4.666	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	140.27	-2.403	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	163.44	-2.148	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	18.53	-3.324	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	296.04	-2.132	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.03465

IONIC BALANCE :

CATIONS (MOL.EQ.)	0.02581681
ANIONS (MOL.EQ.)	0.02422574
DIFFERENCE (%)	6.36

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.31

QUARTZ	73.1
CHALCEDONY	43.1
NAK	212.2

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-20.909	99.999	ALBITE LOW	-19.826	99.999	ANALCIME	-15.755	99.999
ANHYDRITE	-4.748	-5.723	CALCITE	-8.462	-7.775	CHALCEDONY	-3.505	-3.371
MG-CHLORITE	-84.605	99.999	FLUORITE	-10.896	-11.904	GOETHITE	-8.857	99.999
LAUMONDITE	-31.824	99.999	MICROCLINE	-22.879	99.999	MAGNETITE	-33.451	99.999
CA-MONTHOR.	-108.004	99.999	K-MONTHOR.	-54.155	99.999	MG-MONTHOR.	-108.691	99.999
NA-MONTHOR.	-53.451	99.999	MUSCOVITE	-26.733	99.999	PREHNITE	-40.655	99.999
PYRRHOTITE	1.993	99.999	PYRITE	-53.584	99.999	QUARTZ	-3.929	-3.371
WAIKAKITE	-27.547	99.999	MOLLASTONITE	12.857	7.759	ZDISITE	-39.209	99.999
EPIDOTE	-149.027	99.999						

ORKUSTOFNUM JHD
1980-11-21 HORDUR

MADAGASCAR

7911050022 SOURCE DE SAKARAHY, ANTSIRANANA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	6.82/28.0	GAS (VOL.Z)	REFERENCE TEMP.	DEGREES C	27.0 (MEASURED)
SI02	98.60	CO2	SAMPLING PRESSURE	BARS ABS.	
NA	140.70	H2S	DISCHARGE ENTHALPY	MJ/OL/KG	
K	24.20	H2	DISCHARGE	KG/SEC.	0.1
CA	101.50	O2	MEASURED TEMPERATURE	DEGREES C	27.0
MG	71.700	CH4	RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
CO2	408.10	N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0

DISS.SOLIDS	0.00	LITERS GAS PER 'KG	MEASURED DOWNHOLE TEMP.	FLUID INFLOW
AL	0.0000	CONDENSATE/DEG.C	DEGREES C/METERS	DEPTH (METERS)
B	0.8800	CONDENSATE (PPM)		
FE	0.0000	PH/DEG.C	0.0	0.0
NH3	0.0000	CO2	0.0	0.0
H2S	<0.1	H2S	0.0	0.0
*		NA	0.0	0.0
*		CONDENSATE WITH NaOH (PPM)	0.0	0.0
		CO2	0.0	0.0
		H2S	0.0	0.0

IONIC STRENGTH = 0.01784 IONIC BALANCE : CATIONS (MOL.EQ.)0.01741363
ANIONS (MOL.EQ.)0.00778032
DIFFERENCE (%) 76.47

DEEP WATER (PPM)	DEEP STEAM (PPM)	GAS PRESSURES (BARS ABS.)
SI02 98.61	CO2 408.10	CO2 0.597E-01
NA 140.70	H2S 0.00	H2S 0.000E+00
K 24.20	H2 0.00	H2 0.000E+00
CA 101.50	O2 0.00	O2 0.000E+00
MG 71.694	CH4 0.00	CH4 0.000E+00
SO4 3.30	N2 0.00	N2 0.000E+00
CL 30.50	NH3 0.00	NH3 0.000E+00
F 0.19		H2O 0.355E-01
DISS.S. 0.00		TOTAL 0.953E-01
AL 0.0000		
B 0.8799	H2O (%) 0.00	
FE 0.0000	BOILING PORTION 0.00	

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.892	KS04-	0.879	FE++	0.607	FECL+	0.873
OH-	0.871	F-	0.871	FE+++	0.362	AL+++	0.362
H3SI04-	0.873	CL-	0.869	FE0H+	0.878	AL0H++	0.601
H2SI04--	0.601	NA+	0.873	FE(OH)3-	0.878	AL(OH)2+	0.879
H2B03-	0.867	K+	0.869	FE(OH)4--	0.596	AL(OH)4-	0.876
HCO3-	0.873	CA++	0.607	FE0H++	0.596	ALSO4+	0.876
CO3--	0.591	MG++	0.627	FE(OH)2+	0.879	AL(SO4)2-	0.876
HS-	0.871	CAHCO3+	0.882	FE(OH)4-	0.879	ALF++	0.601
S--	0.596	MGHCO3+	0.873	FES04+	0.878	ALF2+	0.879
HS04-	0.876	CAOH+	0.882	FECL++	0.596	ALF4-	0.876
SO4--	0.585	MGOH+	0.883	FECL2+	0.878	ALF5--	0.591
NAS04-	0.879	NH4+	0.867	FECL4-	0.873	ALF6---	0.307

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-6.825	MG++	68.01	-2.553	FE(OH)3	0.00	0.000
OH-	0.00	-7.040	NACL	0.01	-6.939	FE(OH)4-	0.00	0.000
H4SI04	157.56	-2.785	KCL	0.00	-7.918	FECL+	0.00	0.000
H3SI04-	0.16	-5.777	NAS04-	0.02	-6.788	FECL2	0.00	0.000
H2SI04--	0.00	-10.485	KS04-	0.01	-7.173	FECL++	0.00	0.000
NAH3SI04-	0.01	-6.966	CAS04	0.34	-5.607	FECL2+	0.00	0.000
H3B03	5.01	-4.091	MGS04	0.64	-5.274	FECL3	0.00	0.000
H2B03-	0.02	-6.459	CAC03	0.39	-5.405	FECL4-	0.00	0.000
H2CO3	133.70	-2.666	MGC03	0.27	-5.497	FES04	0.00	0.000
HCO3-	418.20	-2.164	CAHCO3+	11.19	-3.956	FES04+	0.00	0.000
CO3--	0.19	-5.503	MGHCO3+	12.22	-3.844	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-8.651	AL0H++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-7.590	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-19.371	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HS04-	0.00	-9.556	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	2.53	-4.580	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.689	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.19	-5.000	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	30.49	-3.065	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	140.69	-2.213	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	24.20	-3.208	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	96.81	-2.617	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01784 IONIC BALANCE : CATIONS (MOL.EQ.)0.01741794
ANIONS (MOL.EQ.)0.00778463
DIFFERENCE (%) 76.45

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.33

QUARTZ	136.5
CHALCEDONY	107.1
NAK	264.1

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

TEOR.	CALC.	TEOR.	CALC.	TEOR.	CALC.
ADULARIA	-21.049	99.999	ALBITE LOW	-19.953	99.999
ANHYDRITE	-4.729	-7.646	CALCITE	-8.446	-8.565
MG-CHLORITE	-84.815	99.999	FLUORITE	-10.917	-12.954
LAUMONDITE	-32.002	99.999	MICROCLINE	-23.039	99.999
CA-MONTHOR.	-108.805	99.999	K-MONTHOR.	-54.593	99.999
NA-MONTHOR.	-53.872	99.999	MUSCOVITE	-26.936	99.999
PYRRHOTITE	2.021	99.999	PYRITE	-53.936	99.999
WAIKAKITE	-27.664	99.999	WOLLASTONITE	12.948	8.030
EPIDOTE	-149.409	99.999			
				ANALCINE	-15.852
				CHALCEDONY	-3.528
				GOETHITE	-8.943
				MAGNETITE	-33.615
				MG-MONTHOR.	-109.475
				PREHNITE	-40.821
				QUARTZ	-3.959
				ZOISITE	-39.354

ORKUSTOFNUM JHD
1980-11-21 HORDUR

MADAGASCAR

7911090024

SOURCE D'ANDRANOMAFANAKELY, ANTSIRANANA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	8.46/30.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	57.0 (MEASURED)
SI02	80.90	CO2			
NA	261.00	H2S	SAMPLING PRESSURE	BARS ABS.	
K	8.70	H2	DISCHARGE ENTHALPY	MJ/OL/KG	
CA	26.90	O2	DISCHARGE	KG/SEC.	2.0
MG	6.840	CH4			
CO2	311.20	N2	MEASURED TEMPERATURE	DEGREES C	57.0
SO4	339.80		RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0
H2S	0.00		EH/TEMP.	MV/DEG.C	0.000/ 0.0
CL	70.00				
F	4.20	LITERS GAS PER 'KG			
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	MEASURED DOWNHOLE TEMP.	DEGREES C/METERS	FLUID INFLOW DEPTH (METERS)
AL	0.0000				
B	0.1100	CONDENSATE (PPM)			
FE	0.0000	PH/DEG.C			
NH3	0.0000	CO2			
H2S	<0.1	H2S			
*		NA			
*					
		CONDENSATE WITH NAOH (PPM)			
		CO2			
		H2S			

IONIC STRENGTH = 0.01882

IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.01304024
 ANIONS (MOL.EQ.) 0.01608503
 DIFFERENCE (%) -20.91

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	80.91	CO2	311.20	CO2	0.00	CO2	0.419E-02
NA	261.00	H2S	0.00	H2S	0.00	H2S	0.000E+00
K	8.70	H2	0.00	H2	0.00	H2	0.000E+00
CA	26.90	O2	0.00	O2	0.00	O2	0.000E+00
MG	6.839	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	339.79	N2	0.00	N2	0.00	N2	0.000E+00
CL	69.99	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	4.20					H2O	0.173E+00
DISS.S.	0.00					TOTAL	0.177E+00
AL	0.0000						
B	0.1100					H2O (%)	0.00
FE	0.0000					BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.886	KSO4-	0.872	FE++	0.589	FECL+	0.866
OH-	0.864	F-	0.864	FE+++	0.342	AL+++	0.342
H3SI04-	0.866	CL-	0.861	FEOH+	0.871	ALOH++	0.582
H2SI04--	0.582	NA+	0.866	FE(OH)3-	0.871	AL(OH)2+	0.872
H2BO3-	0.859	K+	0.861	FE(OH)4--	0.578	AL(OH)4-	0.868
HCO3-	0.866	CA++	0.589	FEOH++	0.578	ALSO4+	0.868
CO3--	0.572	MG++	0.610	FE(OH)2+	0.872	AL(SO4)2-	0.868
HS-	0.864	CAHCO3+	0.875	FE(OH)4-	0.872	ALF++	0.582
S--	0.578	MGHCO3+	0.866	FES04+	0.871	ALF2+	0.872
HSO4-	0.868	CAOH+	0.875	FECL++	0.578	ALF4-	0.868
SO4--	0.566	MGOH+	0.877	FECL2+	0.871	ALF5--	0.572
NASO4-	0.872	NH4+	0.859	FECL4-	0.866	ALF6---	0.285

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-8.209	MG++	4.24	-3.758	FE(OH)3	0.00	0.000
OH-	0.26	-4.821	NACL	0.07	-5.943	FE(OH)4-	0.00	0.000
H4SI04	119.41	-2.906	KCL	0.00	-7.832	FECL+	0.00	0.000
H3SI04-	8.91	-4.028	NASO4-	6.31	-4.276	FECL2	0.00	0.000
H2SI04--	0.01	-6.937	KSO4-	0.60	-5.353	FECL++	0.00	0.000
NAH3SI04-	1.21	-4.988	CASO4	11.59	-4.070	FECL2+	0.00	0.000
H3BO3	0.54	-5.057	MGSO4	10.33	-4.066	FECL3	0.00	0.000
H2BO3-	0.09	-5.852	CACO3	5.56	-4.255	FECL4-	0.00	0.000
H2CO3	4.65	-4.125	MGCO3	0.85	-4.997	FES04	0.00	0.000
HCO3-	412.20	-2.170	CAHCO3+	5.07	-4.300	FES04+	0.00	0.000
CO3--	6.88	-3.941	MGHCO3+	0.91	-4.973	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.01	-7.012	ALOH++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.02	-6.424	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-19.210	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.474	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	317.85	-2.480	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.484	FEOH+	0.00	0.000	ALF++	0.00	0.000
F-	4.20	-3.655	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	69.95	-2.705	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	259.52	-1.947	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	8.53	-3.661	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	19.25	-3.319	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01847

IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.01287684
 ANIONS (MOL.EQ.) 0.01590677
 DIFFERENCE (%) -21.05

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.03

QUARTZ	121.6
CHALCEDONY	91.9
NAK	104.0

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-19.168	99.999	ALBITE LOW	-18.243	99.999	ANALCINE	-14.514	99.999
ANHYDRITE	-5.047	-6.276	CALCITE	-8.737	-7.732	CHALCEDONY	-3.218	-2.906
MG-CHLORITE	-82.149	99.999	FLUORITE	-10.672	-10.987	GOETHITE	-7.705	99.999
LAUMONDITE	-29.603	99.999	MICROCLINE	-20.876	99.999	MAGNETITE	-31.251	99.999
CA-MONTHOR.	-97.627	99.999	K-MONTHOR.	-48.509	99.999	MG-MONTHOR.	-98.508	99.999
NA-MONTHOR.	-48.009	99.999	MUSCOVITE	-24.153	99.999	PREHNITE	-38.676	99.999
PYRRHOTITE	1.644	99.999	PYRITE	-48.999	99.999	QUARTZ	-3.544	-2.906
WAIKAKITE	-26.112	99.999	WOLLASTONITE	11.704	9.964	ZOISITE	-37.509	99.999
EPIDOTE	-144.550	99.999						

ORKUSTOFNUN JHD
1980-11-14 HORDUR

MADAGASCAR

7912210030 RANOMAFANA IFANADIANA (SOURCE 2A), FIANARANTSOA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE		REFERENCE TEMP.		DEGREES C	
PH/DEG.C	9.30/26.0	GAS (VOL.%)				55.0 (MEASURED)	
SI02	38.60	CO2					
NA	55.10	H2S		SAMPLING PRESSURE	BARS ABS.		
K	1.31	H2		DISCHARGE ENTHALPY	MJ/OL/KG		
CA	3.10	O2		DISCHARGE	KG/SEC.	0.1	
MG	0.230	CH4					
CO2	36.50	N2		MEASURED TEMPERATURE	DEGREES C	55.0	
SO4	69.10			RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0	
H2S	0.20			EH/TEMP.	MV/DEG.C	0.000/ 0.0	
CL	3.10						
F	2.28	LITERS GAS PER 'KG		MEASURED DOWNHOLE TEMP.			
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	/	DEGREES C/METERS			FLUID INFLOW
AL	0.0000						DEPTH (METERS)
B	0.0100	CONDENSATE (PPM)		0.0	0.0	0.0	
FE	0.0000	PH/DEG.C	/	0.0	0.0	0.0	
NH3	0.0000	CO2		0.0	0.0	0.0	
*		H2S		0.0	0.0	0.0	
*		NA		0.0	0.0	0.0	
*				0.0	0.0	0.0	
				0.0	0.0	0.0	
		CONDENSATE WITH NaOH (PPM)		0.0	0.0	0.0	
		CO2		0.0	0.0	0.0	
		H2S		0.0	0.0	0.0	

IONIC STRENGTH = 0.00351 IONIC BALANCE : CATIONS (MOL.EQ.)0.00257875
ANIONS (MOL.EQ.)0.00270524
DIFFERENCE (%) -4.79

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	38.60	CO2	36.50	CO2	0.112E-03
NA	55.10	H2S	0.20	H2S	0.862E-06
K	1.31	H2	0.00	H2	0.000E+00
CA	3.10	O2	0.00	O2	0.000E+00
MG	0.230	CH4	0.00	CH4	0.000E+00
SO4	69.10	N2	0.00	N2	0.000E+00
CL	3.10	NH3	0.00	NH3	0.000E+00
F	2.28			H2O	0.157E+00
DISS.S.	0.00			TOTAL	0.157E+00
AL	0.0000				
B	0.0100			H2O (%)	0.00
FE	0.0000			BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.940	KSO4-	0.936	FE++	0.772	FECL+	0.935
OH-	0.934	F-	0.934	FE+++	0.575	AL+++	0.575
H3SI04-	0.935	CL-	0.934	FE0H+	0.936	AL0H+	0.769
H2SI04--	0.769	NA+	0.935	FE(OH)3-	0.936	AL(OH)2+	0.936
H2BO3-	0.933	K+	0.934	FE(OH)4--	0.768	AL(OH)4-	0.935
HCO3-	0.935	CA++	0.772	FE0H++	0.768	ALSO4+	0.935
CO3--	0.766	MG++	0.778	FE(OH)2+	0.936	AL(SO4)2-	0.935
HS-	0.934	CANCO3+	0.937	FE(OH)4-	0.936	ALF++	0.769
S--	0.768	MGHCO3+	0.935	FESO4+	0.936	ALF2+	0.936
HSO4-	0.935	CAOH+	0.937	FECL++	0.768	ALF4-	0.935
SO4--	0.764	MGOH+	0.937	FECL2+	0.936	ALF5--	0.766
NASO4-	0.936	NH4+	0.933	FECL4-	0.935	ALF6----	0.549

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

HI (ACT.)	0.00	-8.850	MG++	0.19	-5.114	FE(OH)3	0.00	0.000
OH-	0.93	-4.263	NACL	0.00	-7.930	FE(OH)4-	0.00	0.000
H4SI04	47.64	-3.305	KCL	0.00	-9.944	FECL+	0.00	0.000
H3SI04-	13.54	-3.847	NASO4-	0.38	-5.496	FECL2	0.00	0.000
H2SI04--	0.06	-6.224	KSO4-	0.03	-6.715	FECL++	0.00	0.000
NAH3SI04-	0.46	-5.413	CASO4	0.60	-5.359	FECL2+	0.00	0.000
H3BO3	0.04	-6.246	MGSO4	0.16	-5.875	FECL3	0.00	0.000
H2BO3-	0.02	-6.447	CACO3	0.51	-5.290	FECL4-	0.00	0.000
H2CO3	0.13	-5.672	MCCO3	0.02	-6.532	FESO4	0.00	0.000
HCO3-	47.30	-3.111	CANCO3+	0.10	-6.001	FESO4+	0.00	0.000
CO3--	2.73	-4.342	MGHCO3+	0.01	-7.169	AL+++	0.00	0.000
H2S	0.00	-7.346	CAOH+	0.00	-7.198	ALOH++	0.00	0.000
HS-	0.19	-5.235	MGOH+	0.00	-7.120	AL(OH)2+	0.00	0.000
S--	0.00	-12.920	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-21.083	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-9.711	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	68.23	-3.149	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-9.373	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	2.28	-3.921	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	3.10	-4.058	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	54.94	-2.622	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	1.30	-4.477	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	2.68	-4.175	FE(OH)2+	0.00	0.000	ALF6----	0.00	0.000

IONIC STRENGTH = 0.00347 IONIC BALANCE : CATIONS (MOL.EQ.)0.00257309
ANIONS (MOL.EQ.)0.00269854
DIFFERENCE (%) -4.76

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.05

QUARTZ	79.2
CHALCEDONY	49.3
NAK	83.2

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.391 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-19.282	99.999	ALBITE LOW	-18.346	99.999	ANALCIME	-14.596	99.999
ANHYDRITE	-5.024	-7.553	CALCITE	-8.715	-8.745	CHALCEDONY	-3.237	-3.305
MG-CHLORITE	-82.297	99.999	FLUORITE	-10.684	-12.189	GOETHITE	-7.785	99.999
LAUMONDITE	-29.749	99.999	MICROCLINE	-21.007	99.999	MAGNETITE	-31.404	99.999
CA-MONTHOR.	-98.330	99.999	K-MONTHOR.	-48.892	99.999	MG-MONTHOR.	-99.203	99.999
NA-MONTHOR.	-48.379	99.999	MUSCOVITE	-24.326	99.999	PREHNITE	-38.799	99.999
PYRRHOTITE	1.666	99.999	PYRITE	-49.306	99.999	QUARTZ	-3.569	-3.305
WAIKAKITE	-26.206	99.999	WOLLASTONITE	11.780	10.107	ZOISITE	-37.615	99.999
EPIDOTE	-144.820	99.999						

ORKUSTOFNUM JHD
1980-11-21 HORDUR

MADAGASCAR

8001270032 SOURCE, ANDRANOMAFANA ANDONAKY (SAKANAVAKA), TOLIARY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE		REFERENCE TEMP.		DEGREES C	
PH/DEG.C	8.41/27.0	GAS (VOL.Z)		58.0	(MEASURED)		
SI02	32.30	CO2					
NA	304.50	H2S					
K	6.10	H2					
CA	20.30	O2					
MG	4.000	CH4					
CO2	278.60	N2					
SO4	160.60						
H2S	0.00						
CL	164.80						
F	0.75						
DISS.SOLIDS	0.00						
AL	0.0000						
R	0.4200						
FE	0.0000						
NH3	<0.14						
*							
*							

IONIC STRENGTH = 0.01668 IONIC BALANCE :

CATIONS (MOL.EQ.)	0.01454246
ANIONS (MOL.EQ.)	0.01425752
DIFFERENCE (%)	1.98

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	32.30	CO2	278.60	CO2	0.430E-02
NA	304.50	H2S	0.00	H2S	0.000E+00
K	6.10	H2	0.00	H2	0.000E+00
CA	20.30	O2	0.00	O2	0.000E+00
MG	4.000	CH4	0.00	CH4	0.000E+00
SO4	160.60	N2	0.00	N2	0.000E+00
CL	164.79	NH3	0.00	NH3	0.000E+00
F	0.75			H2O	0.181E+00
DISS.S.	0.00			TOTAL	0.186E+00
AL	0.0000				
R	0.4200				
FE	0.0000				

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.890	KSO4-	0.878	FE++	0.602	FECL+	0.872
OH-	0.870	F-	0.870	FE+++	0.356	AL+++	0.356
H3SI04-	0.872	CL-	0.867	FE0H+	0.876	AL0H++	0.596
H2SI04--	0.596	NA+	0.872	FE(OH)3-	0.876	AL(OH)2+	0.878
H2BO3-	0.865	K+	0.867	FE(OH)4--	0.592	AL(OH)4-	0.874
HCO3-	0.872	CA++	0.602	FE0H++	0.592	ALSO4+	0.874
CO3--	0.586	MG++	0.622	FE(OH)2+	0.878	AL(SO4)2-	0.874
HS-	0.870	CANCO3+	0.880	FE(OH)4-	0.878	ALF++	0.596
S--	0.592	MGHCO3+	0.872	FES04+	0.876	ALF2+	0.878
HSO4-	0.874	CAOH+	0.880	FECL++	0.592	ALF4-	0.874
SO4--	0.581	MGOH+	0.882	FECL2+	0.876	ALF5--	0.586
NASO4-	0.878	NH4+	0.865	FECL4-	0.872	ALF6---	0.301

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-8.161	MG++	2.94	-3.917	FE(OH)3	0.00	0.000
OH-	0.24	-4.849	NACL	0.19	-5.483	FE(OH)4-	0.00	0.000
H4SI04	47.93	-3.302	KCL	0.00	-7.598	FECL+	0.00	0.000
H3SI04-	3.28	-4.463	NASO4-	3.65	-4.513	FECL2	0.00	0.000
H2SI04--	0.00	-7.417	KSO4-	0.21	-5.808	FECL++	0.00	0.000
NAH3SI04-	0.53	-5.350	CASO4	4.81	-4.452	FECL2+	0.00	0.000
H3BO3	2.10	-4.469	MGSO4	3.66	-4.517	FECL3	0.00	0.000
H2BO3-	0.30	-5.312	CACO3	3.90	-4.409	FECL4-	0.00	0.000
H2CO3	4.70	-4.120	MGCO3	0.50	-5.229	FES04	0.00	0.000
HCO3-	370.57	-2.217	CANCO3+	3.93	-4.411	FES04+	0.00	0.000
CO3--	5.47	-4.040	MGHCO3+	0.58	-5.165	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-7.111	AL0H++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.01	-6.596	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-19.397	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.727	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	151.18	-2.803	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-9.172	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.75	-4.404	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	164.67	-2.333	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	303.62	-1.879	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	6.04	-3.811	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	15.76	-3.405	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01647 IONIC BALANCE :

CATIONS (MOL.EQ.)	0.01443565
ANIONS (MOL.EQ.)	0.01414092
DIFFERENCE (%)	2.06

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	79.5
CHALCEDONY	49.5
NAK	72.5

1000/T DEGREES KELVIN = 3.02

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-19.112	99.999	ALBITE LOW	-18.192	99.999	ANALCIME	-14.473	99.999
ANHYDRITE	-5.059	-6.665	CALCITE	-8.749	-7.898	CHALCEDONY	-3.209	-3.302
MG-CHLORITE	-82.076	99.999	FLUORITE	-10.667	-12.554	GOETHITE	-7.664	99.999
LAUMONDITE	-29.530	99.999	MICROCLINE	-20.811	99.999	MAGNETITE	-31.174	99.999
CA-MONTMOR.	-97.273	99.999	K-MONTMOR.	-48.318	99.999	MG-MONTMOR.	-98.164	99.999
NA-MONTMOR.	-47.826	99.999	MUSCOVITE	-24.067	99.999	PREHNITE	-38.615	99.999
PYRRHOTITE	1.633	99.999	PYRITE	-48.847	99.999	QUARTZ	-3.531	-3.302
WAIKAKITE	-26.066	99.999	WOLLASTONITE	11.667	9.394	ZOISITE	-37.456	99.999
EPIDOTE	-144.418	99.999						

ORKUSTOFNUN JID
1980-11-14 HORDUR

MADAGASCAR

8002060043

RANOMAY (TONGODORY), TOLIARY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	7.51/25.0
SI02	26.00
NA	997.30
K	32.10
CA	159.40
MG	18.300
CO2	172.90
SO4	671.00
H2S	0.27
CL	1345.30
F	1.35
DISS.SOLIDS	0.00
AL	0.0000
B	1.4500
FE	0.0000
NH3	0.0000
*	
*	
*	

GAS (VOL.%)

CO2

H2S

H2

O2

CH4

N2

LITERS GAS PER 'KG

CONDENSATE/DEG.C

CONDENSATE (PPM)

PH/DEG.C

CO2

H2S

NA

CONDENSATE WITH NaOH (PPM)

CO2

H2S

REFERENCE TEMP. DEGREES C 44.5 (MEASURED)

SAMPLING PRESSURE BARS ABS.

DISCHARGE ENTHALPY KJOUL/KG

DISCHARGE KG/SEC. 20.0

MEASURED TEMPERATURE DEGREES C 44.5

RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0

EH/TEMP. MV/DEG.C 0.000/ 0.0

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0

IONIC STRENGTH = 0.06346

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.05220952
ANIONS (MOL.EQ.) 0.05408251
DIFFERENCE (%) -3.52

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	26.00
NA	997.30
K	32.10
CA	159.40
MG	18.298
SO4	670.99
CL	1345.19
F	1.35
DISS.S.	0.00
AL	0.0000
B	1.4499
FE	0.0000

CO2	172.90
H2S	0.27
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

CO2	0.977E-02
H2S	0.218E-04
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.932E-01
TOTAL	0.103E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

HH	0.836	KSO4-	0.807	FE++	0.444	FECL+	0.792
OH-	0.787	F-	0.787	FE+++	0.210	AL+++	0.210
H3SI04-	0.792	CL-	0.780	FE0H+	0.803	AL0H+	0.432
H2SI04--	0.432	NA+	0.792	FE(OH)3-	0.803	AL(OH)2+	0.807
H2BO3-	0.774	K+	0.780	FE(OH)4--	0.423	AL(OH)4-	0.798
HCO3-	0.792	CA++	0.444	FE0H++	0.423	ALSO4+	0.798
CO3--	0.413	MG++	0.481	FE(OH)2+	0.807	AL(SO4)2-	0.798
HS-	0.787	CAHCO3+	0.813	FE(OH)4-	0.807	ALF++	0.432
S--	0.423	MGHCO3+	0.792	FES04+	0.803	ALF2+	0.807
HSO4-	0.798	CAOH+	0.813	FECL++	0.423	ALF4-	0.798
SO4--	0.401	MGOH+	0.817	FECL2+	0.803	ALF5--	0.413
NASO4-	0.807	NH4+	0.774	FECL4-	0.792	ALF6---	0.137

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

HH (ACT.)	0.00	-7.420	MG++	13.13	-3.267	FE(OH)3	0.00	0.000
OH-	0.02	-5.886	NACL	2.75	-4.327	FE(OH)4-	0.00	0.000
H4SI04	41.10	-3.369	KCL	0.05	-6.146	FECL+	0.00	0.000
H3SI04-	0.36	-5.422	NASO4-	26.52	-3.652	FECL2	0.00	0.000
H2SI04--	0.00	-9.174	KSO4-	2.35	-4.760	FECL++	0.00	0.000
NAH3SI04-	0.16	-5.867	CASO4	67.14	-3.307	FECL2+	0.00	0.000
H3BO3	8.09	-3.883	MGSO4	23.89	-3.702	FECL3	0.00	0.000
H2BO3-	0.20	-5.480	CACO3	1.49	-4.828	FECL4-	0.00	0.000
H2CO3	14.21	-3.640	MCCO3	0.12	-5.844	FES04	0.00	0.000
HCO3-	217.41	-2.448	CAHCO3+	9.79	-4.014	FES04+	0.00	0.000
CO3--	0.66	-4.959	MGHCO3+	1.07	-4.904	AL+++	0.00	0.000
H2S	0.05	-5.858	CAOH+	0.00	-7.420	ALOH+	0.00	0.000
HS-	0.22	-5.185	MGOH+	0.00	-7.175	AL(OH)2+	0.00	0.000
S--	0.00	-14.264	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.863	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-7.695	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	581.48	-2.218	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.335	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	1.35	-4.148	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	1343.49	-1.421	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	991.07	-1.365	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	31.39	-3.095	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	135.15	-2.472	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.06274

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.05184556
ANIONS (MOL.EQ.) 0.05367560
DIFFERENCE (%) -3.47

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.15

QUARTZ	73.2
CHALCEDONY	43.3
HAK	100.7

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.261 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-19.902	99.999	ALBITE LOW	-18.911	99.999	ANALCINE	-15.043	99.999
ANHYDRITE	-4.906	-5.439	CALCITE	-8.603	-8.169	CHALCEDONY	-3.341	-3.369
MG-CHLORITE	-83.140	99.999	FLUORITE	-10.756	-11.330	GOETHITE	-8.211	99.999
LAUMONDITE	-30.542	99.999	MICROCLINE	-21.722	99.999	MAGNETITE	-32.216	99.999
CA-MONTHOR.	-102.109	99.999	K-MONTHOR.	-50.942	99.999	MG-MONTHOR.	-102.916	99.999
NA-MONTHOR.	-50.357	99.999	MUSCOVITE	-25.258	99.999	PREHNITE	-39.488	99.999
PYRRHOTITE	1.788	99.999	PYRITE	-50.967	99.999	QUARTZ	-3.707	-3.369
WAIKAKITE	-26.715	99.999	WOLLASTONITE	12.193	8.646	ZOISITE	-38.206	99.999
EPIDOTE	-146.356	99.999						

ORKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

8003060044

TSIEFA ANDRANOMAFANA, FIAMARANTSOA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	7.55/21.0
SI02	29.50
NA	144.00
K	5.30
CA	341.90
MG	0.650
CO2	11.40
SO4	1098.60
H2S	2.86
CL	35.30
F	2.88
DISS.SOLIDS	0.00
AL	0.0000
B	0.1300
FE	0.0000
NH3	0.0000

GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	50.0 (MEASURED)
CO2	SAMPLING PRESSURE	BARS ABS.	
H2S	DISCHARGE ENTHALPY	KJ/DEG.C	
H2	DISCHARGE	KG/SEC.	0.5
O2	MEASURED TEMPERATURE	DEGREES C	50.0
CH4	RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C

MEASURED DOWNHOLE TEMP.
DEGREES C/METERS

FLUID INFLOW
DEPTH (METERS)

CONDENSATE (PPM)

PH/DEG.C

CO2
H2S
NA

CONDENSATE WITH NAOH (PPM)

CO2
H2S

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0

IONIC STRENGTH = 0.03693

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.02003117
ANIONS (MOL.EQ.) 0.02080153
DIFFERENCE (%) -3.77

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	29.50
NA	144.00
K	5.30
CA	341.90
MG	0.650
SO4	1098.58
CL	35.30
F	2.88
DISS.S.	0.00
AL	0.0000
B	0.1300
FE	0.0000

CO2	11.40
H2S	2.86
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

CO2	0.920E-03
H2S	0.305E-03
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.123E+00
TOTAL	0.124E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.861	KSO4-	0.840	FE++	0.512	FECL+	0.830
OH-	0.826	F-	0.826	FE+++	0.267	AL+++	0.267
H3SI04-	0.830	CL-	0.822	FE0H+	0.837	AL0H+	0.503
H2SI04--	0.503	NA+	0.830	FE(OH)3-	0.837	AL(OH)2+	0.840
H2BO3-	0.818	K+	0.822	FE(OH)4--	0.496	AL(OH)4-	0.834
HCO3-	0.830	CA++	0.512	FE0H++	0.496	ALSO4+	0.834
CO3--	0.488	MG++	0.541	FE(OH)2+	0.840	AL(SO4)2-	0.834
HS-	0.826	CAHCO3+	0.844	FE(OH)4-	0.840	ALF++	0.503
S---	0.496	MGHCO3+	0.830	FESO4+	0.837	ALF2+	0.840
HSO4-	0.834	CAOH+	0.844	FECL++	0.496	ALF4-	0.834
SO4--	0.479	MGOH+	0.847	FECL2+	0.837	ALF5--	0.488
NASO4-	0.840	NH4+	0.818	FECL4-	0.830	ALF6---	0.200

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.303	MG++	0.35	-4.845	FE(OH)3	0.00	0.000
OH-	0.02	-5.880	NACL	0.01	-6.634	FE(OH)4-	0.00	0.000
H4SI04	46.81	-3.313	KCL	0.00	-8.439	FECL+	0.00	0.000
H3SI04-	0.36	-5.420	NASO4-	7.49	-4.201	FECL2	0.00	0.000
H2SI04--	0.00	-9.267	KSO4-	0.76	-5.251	FECL++	0.00	0.000
NAH3SI04-	0.03	-6.672	CASO4	288.12	-2.674	FECL2+	0.00	0.000
H3BO3	0.73	-4.928	MGSO4	1.49	-4.906	FECL3	0.00	0.000
H2BO3-	0.01	-6.643	CACO3	0.20	-5.704	FECL4-	0.00	0.000
H2CO3	1.19	-4.717	MSCO3	0.00	-8.613	FESO4	0.00	0.000
HCO3-	13.53	-3.654	CAHCO3+	1.57	-4.808	FESO4+	0.00	0.000
CO3--	0.03	-6.308	MGHCO3+	0.00	-7.618	AL+++	0.00	0.000
H2S	0.59	-4.758	CAOH+	0.01	-7.044	AL0H+	0.00	0.000
HS-	2.20	-4.177	MGOH+	0.00	-8.660	AL(OH)2+	0.00	0.000
S---	0.00	-13.342	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.216	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.01	-7.267	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	887.50	-2.034	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.821	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	2.08	-3.819	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	35.29	-3.002	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	142.54	-2.208	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	5.08	-3.886	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	256.37	-2.194	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.03519

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01916737
ANIONS (MOL.EQ.) 0.01991965
DIFFERENCE (%) -3.85

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.09

QUARTZ	78.5
CHALCEDONY	48.5
NAK	109.4

OXIDATION POTENTIAL (VOLTS) :
EH H2S= -0.269 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

ADULARIA	TEOR. -19.572	CALC. 99.999	ALBITE LOW	TEOR. -18.610	CALC. 99.999	ANALCINE	TEOR. -14.806	CALC. 99.999
ANHYDRITE	TEOR. -4.967	CALC. 99.999	CALCITE	TEOR. -8.660	CALC. -9.104	CHALCEDONY	TEOR. -3.286	CALC. -3.313
MG-CHLORITE	TEOR. -82.684	CALC. 99.999	FLUORITE	TEOR. -10.716	CALC. -10.289	GOETHITE	TEOR. -7.907	CALC. 99.999
LAUMONDITE	TEOR. -30.120	CALC. 99.999	MICROCLINE	TEOR. -21.341	CALC. 99.999	MAGNETITE	TEOR. -31.788	CALC. 99.999
CA-MONTHOR.	TEOR. -100.115	CALC. 99.999	K-MONTHOR.	TEOR. -49.857	CALC. 99.999	MG-MONTHOR.	TEOR. -100.959	CALC. 99.999
NA-MONTHOR.	TEOR. -49.312	CALC. 99.999	MUSCOVITE	TEOR. -24.764	CALC. 99.999	PREHNITE	TEOR. -39.119	CALC. 99.999
PYRRHOTITE	TEOR. 1.723	CALC. 99.999	PYRITE	TEOR. -50.086	CALC. 99.999	QUARTZ	TEOR. -3.634	CALC. -3.313
WAIRAKITE	TEOR. -26.444	CALC. 99.999	WOLLASTONITE	TEOR. 11.973	CALC. 8.809	ZOISITE	TEOR. -37.890	CALC. 99.999
EPIDOTE	TEOR. -145.525	CALC. 99.999						

ORKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

9003140050

RANOMAFANA D'ANJOHIBE, ANTANANARIVO, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPH)

STEAM SAMPLE

PH/DEG.C	8.53/21.0
SI02	45.00
NA	220.70
K	5.90
CA	81.10
MG	0.470
CO2	17.20
SO4	496.70
H2S	0.10
CL	89.50
F	6.20
DISS.SOLIDS	0.00
AL	0.0000
B	0.0900
FE	0.0000
NH3	0.0000

GAS (VOL.%)	
CO2	
H2S	
H2	
O2	
CH4	
N2	

REFERENCE TEMP. DEGREES C 50.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/OL/KG
DISCHARGE KG/SEC. 2.0

MEASURED TEMPERATURE DEGREES C 50.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

MEASURED DOWNHOLE TEMP. FLUID INFLOW
DEGREES C/METERS DEPTH (METERS)

CONDENSATE (PPH)	
PH/DEG.C /	
CO2	0.0
H2S	0.0
NA	0.0

CONDENSATE WITH NAOH (PPH)	
CO2	0.0
H2S	0.0

IONIC STRENGTH = 0.01963

IONIC BALANCE : CATIONS (MOL.EQ.)0.01317868
ANIONS (MOL.EQ.)0.01292985
DIFFERENCE (%) 1.91

DEEP WATER (PPH)

SI02	45.00
NA	220.70
K	5.90
CA	81.10
MG	0.470
SO4	496.69
CL	89.49
F	6.20
DISS.S.	0.00
AL	0.0000
B	0.0900
FE	0.0000

DEEP STEAM (PPH)

CO2	17.20
H2S	0.10
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.275E-03
H2S	0.233E-05
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.123E+00
TOTAL	0.123E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.886	KSO4-	0.872	FE++	0.588	FECL+	0.865
OH-	0.863	F-	0.863	FE+++	0.341	AL+++	0.341
H3SI04--	0.865	CL-	0.860	FE0H+	0.870	ALOH++	0.581
H2SI04--	0.581	NA+	0.865	FE(OH)3-	0.870	AL(OH)2+	0.872
H2BO3-	0.858	K+	0.860	FE(OH)4--	0.576	AL(OH)4-	0.868
HCO3-	0.865	CA++	0.588	FE0H++	0.576	ALSO4+	0.868
CO3--	0.570	MG++	0.609	FE(OH)2+	0.872	AL(SO4)2--	0.868
HS-	0.863	CAHCO3+	0.874	FE(OH)4-	0.872	ALF++	0.581
S---	0.576	MGMCO3+	0.865	FES04+	0.870	ALF2+	0.872
HSO4-	0.868	CAOH+	0.874	FECL++	0.576	ALF4-	0.868
SO4--	0.564	MGOH+	0.877	FECL2+	0.870	ALF5--	0.570
NASO4-	0.872	NH4+	0.858	FECL4-	0.865	ALF6---	0.283

CHEMICAL COMPONENTS IN DEEP WATER (PPH AND LOG MOLE)

H+ (ACT.)	0.00	-8.065	MG++	0.29	-4.916	FE(OH)3	0.00	0.000
OH-	0.12	-5.138	NACL	0.06	-6.004	FE(OH)4-	0.00	0.000
H4SI04	68.73	-3.146	KCL	0.00	-7.941	FECL+	0.00	0.000
H3SI04-	2.94	-4.509	NASO4-	6.97	-4.233	FECL2	0.00	0.000
H2SI04--	0.00	-7.640	KSO4-	0.52	-5.414	FECL++	0.00	0.000
NAH3SI04-	0.34	-5.538	CASO4	50.96	-3.427	FECL2+	0.00	0.000
H3BO3	0.47	-5.123	MGSO4	0.86	-5.147	FECL3	0.00	0.000
H2BO3-	0.05	-6.098	CACD3	0.58	-5.237	FECL4-	0.00	0.000
H2CO3	0.36	-5.241	MGCO3	0.00	-7.634	FES04	0.00	0.000
HCO3-	22.42	-3.435	CAHCO3+	0.77	-5.118	FES04+	0.00	0.000
CO3--	0.25	-5.377	MGMCO3+	0.00	-7.419	AL+++	0.00	0.000
H2S	0.00	-6.876	CAOH+	0.01	-6.830	ALOH++	0.00	0.000
HS-	0.09	-5.553	MGOH+	0.00	-7.934	AL(OH)2+	0.00	0.000
S---	0.00	-14.002	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-18.959	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.266	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	454.05	-2.325	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.231	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	6.20	-3.486	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	89.46	-2.598	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	219.26	-2.021	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	5.75	-3.833	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	65.55	-2.786	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01923

IONIC BALANCE : CATIONS (MOL.EQ.)0.01298764
ANIONS (MOL.EQ.)0.01272102
DIFFERENCE (%) 2.07

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.09

QUARTZ	95.0
CHALCEDONY	65.0
NAK	89.2

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.315 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-19.572	99.999	ALBITE LOW	-18.610	99.999	ANALCIME	-14.806	99.999
ANHYDRITE	-4.967	-5.591	CALCITE	-8.660	-8.637	CHALCEDONY	-3.286	-3.146
MG-CHLORITE	-82.684	99.999	FLUORITE	-10.716	-10.118	GOETHITE	-7.987	99.999
LAUMONDITE	-30.120	99.999	MICROCLINE	-21.341	99.999	MAGNETITE	-31.788	99.999
CA-MONTHOR.	-100.115	99.999	K-MONTHOR.	-49.857	99.999	MG-MONTHOR.	-100.959	99.999
NA-MONTHOR.	-49.312	99.999	MUSCOVITE	-24.764	99.999	PREHNITE	-39.119	99.999
PYRRHOTITE	1.723	99.999	PYRITE	-50.086	99.999	QUARTZ	-3.634	-3.146
WAIRAKITE	-26.444	99.999	WOLLASTONITE	11.973	9.967	ZOISITE	-37.890	99.999
EPIDOTE	-145.525	99.999						

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

8004030065

RANOMAFANA IMODY, FIANARANTSOA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

PH/DEG.C	9.21/19.0
SI02	54.40
NA	92.10
K	3.40
CA	6.40
MG	0.146
CO2	27.60
SO4	158.60
H2S	0.20
CL	10.70
F	6.36
DISS.SOLIDS	0.00
AL	0.0000
B	0.0800
FE	0.0000
NH3	0.0000

STEAM SAMPLE

GAS (VOL.%)
CO2
H2S
H2
O2
CH4
N2

REFERENCE TEMP. DEGREES C 48.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/OL/KG
DISCHARGE KG/SEC. 3.0

MEASURED TEMPERATURE DEGREES C 48.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

CONDENSATE (PPM)	0.0	0.0	0.0
PH/DEG.C	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
NA	0.0	0.0	0.0

CONDENSATE WITH NaOH (PPM)	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.00637

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.00437565
ANIONS (MOL.EQ.) 0.00471270
DIFFERENCE (%) -7.42

DEEP WATER (PPM)

SI02	54.40
NA	92.10
K	3.40
CA	6.40
MG	0.146
SO4	158.60
CL	10.70
F	6.36
DISS.S.	0.00
AL	0.0000
B	0.0800
FE	0.0000

DEEP STEAM (PPM)

CO2	27.60
H2S	0.20
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.100E-03
H2S	0.113E-05
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.111E+00
TOTAL	0.112E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.924	KSO4-	0.918	FE++	0.716	FECL+	0.916
OH-	0.915	F-	0.915	FE+++	0.496	AL+++	0.496
H3SI04-	0.916	CL-	0.914	FE0H+	0.918	AL0H++	0.713
H2SI04--	0.713	NA+	0.916	FE(OH)3-	0.918	AL(OH)2+	0.918
H2BO3-	0.913	K+	0.914	FE(OH)4--	0.711	AL(OH)4-	0.917
HCO3-	0.916	CA++	0.716	FE0H++	0.711	ALSO4+	0.917
CO3--	0.708	MG++	0.727	FE(OH)2+	0.918	AL(SO4)2-	0.917
HS-	0.915	CAHCO3+	0.920	FE(OH)4-	0.918	ALF++	0.713
S--	0.711	MGHCO3+	0.916	FESO4+	0.918	ALF2+	0.918
HSO4-	0.917	CAOH+	0.920	FECL++	0.711	ALF4-	0.917
SO4--	0.705	MGOH+	0.920	FECL2+	0.918	ALF5--	0.708
NASO4-	0.918	NH4+	0.913	FECL4-	0.916	ALF6---	0.460

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-8.720	MG++	0.11	-5.340	FE(OH)3	0.00	0.000
OH-	0.47	-4.559	NACL	0.00	-7.281	FE(OH)4-	0.00	0.000
H4SI04	73.70	-3.115	KCL	0.00	-9.056	FECL+	0.00	0.000
H3SI04-	12.60	-3.878	NASO4-	1.23	-4.987	FECL2	0.00	0.000
H2SI04--	0.03	-6.441	KSO4-	0.13	-6.023	FECL++	0.00	0.000
NAH3SI04-	0.69	-5.234	CASO4	2.19	-4.794	FECL2+	0.00	0.000
H3BO3	0.32	-5.289	MGSO4	0.16	-5.883	FECL3	0.00	0.000
H2BO3-	0.14	-5.646	CACO3	0.43	-5.368	FECL4-	0.00	0.000
H2CO3	0.14	-5.661	MGC03	0.01	-7.114	FESO4	0.00	0.000
HCO3-	36.23	-3.226	CAHCO3+	0.12	-5.919	FESO4+	0.00	0.000
CO3--	1.54	-4.591	MGHCO3+	0.00	-7.564	AL+++	0.00	0.000
H2S	0.00	-7.174	CAOH+	0.00	-7.245	ALOH++	0.00	0.000
HS-	0.19	-5.236	MGOH+	0.00	-7.709	AL(OH)2+	0.00	0.000
S--	0.00	-13.125	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-20.693	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-9.338	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	155.85	-2.790	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.867	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	6.36	-3.475	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	10.70	-3.520	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	91.73	-2.399	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	3.36	-4.065	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	5.53	-3.860	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00632

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.00436250
ANIONS (MOL.EQ.) 0.00469513
DIFFERENCE (%) -7.34

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.11

QUARTZ	98.2
CHALCEDONY	68.2
NAK	112.0

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.363 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-19.691	99.999	ALBITE LOW	-18.718	99.999	ANALCINE	-14.891	99.999
ANHYDRITE	-4.945	-6.946	CALCITE	-8.639	-8.746	CHALCEDONY	-3.306	-3.115
MG-CHLORITE	-82.846	99.999	FLUORITE	-10.730	-11.033	GOETHITE	-8.068	99.999
LAUMONDITE	-30.272	99.999	MICROCLINE	-21.478	99.999	MAGNETITE	-31.943	99.999
CA-MONTHOR.	-100.836	99.999	K-MONTHOR.	-50.250	99.999	MG-MONTHOR.	-101.666	99.999
NA-MONTHOR.	-49.688	99.999	MUSCOVITE	-24.943	99.999	PREHNITE	-39.250	99.999
PYRRHOTITE	1.746	99.999	PYRITE	-50.403	99.999	QUARTZ	-3.660	-3.115
WAIKAKITE	-26.542	99.999	WOLLASTONITE	12.052	10.319	ZOISITE	-38.003	99.999
EPIDOTE	-145.821	99.999						

ORKUSTOFNUN JHD
1980-11-21 HORUR

MADAGASCAR

8004040067

SOURCE DE MAHASOA, FIANARANTSOA, MADAGASCAR.

PROGRAM MATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	8.30/18.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	28.0 (MEASURED)
SiO2	33.10	CO2	SAMPLING PRESSURE	BARS ABS.	
NA	47.40	H2S	DISCHARGE ENTHALPY	MJOUL/KG	
K	2.80	H2	DISCHARGE	KG/SEC.	0.5
CA	5.10	O2	MEASURED TEMPERATURE	DEGREES C	28.0
MG	0.310	CH4	RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0
CO2	14.50	N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0
SO4	74.90		MEASURED DOWNHOLE TEMP.	DEGREES C/METERS	
H2S	0.27		FLUID INFLOW	DEPTH (METERS)	
CL	114.30				
F	3.15	LITERS GAS PER 'KG			
DISS.SOLIDS	0.00	CONDENSATE/DEG.C			
AL	0.0000				
B	0.0500	CONDENSATE (PPM)			
FE	0.0000	PH/DEG.C			
NH3	0.0000	CO2			
*		H2S			
*		NA			
		CONDENSATE WITH NaOH (PPM)			
		CO2			
		H2S			

IONIC STRENGTH = 0.00475

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.00239800
ANIONS (MOL.EQ.) 0.00528017
DIFFERENCE (%) -75.07

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SiO2	33.10	CO2	14.50	CO2	0.00	CO2	0.147E-03
NA	47.40	H2S	0.27	H2S	0.00	H2S	0.557E-05
K	2.80	H2	0.00	H2	0.00	H2	0.000E+00
CA	5.10	O2	0.00	O2	0.00	O2	0.000E+00
MG	0.310	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	74.90	N2	0.00	N2	0.00	N2	0.000E+00
CL	114.29	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	3.15					H2O	0.377E-01
DISS.S.	0.00					TOTAL	0.378E-01
AL	0.0000						
B	0.0500					H2O (%)	0.00
FE	0.0000					BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.934	KSO4-	0.930	FE++	0.751	FECL+	0.928
OH-	0.927	F-	0.927	FE+++	0.545	AL+++	0.545
H3SiO4-	0.928	CL-	0.926	FE0H+	0.929	ALOH++	0.749
H2SiO4--	0.749	NA+	0.928	FE(OH)3-	0.929	AL(OH)2+	0.930
H2BO3-	0.926	K+	0.926	FE(OH)4--	0.747	AL(OH)4-	0.929
HCO3-	0.928	CA++	0.751	FE0H++	0.747	ALSO4+	0.929
CO3--	0.745	MG++	0.760	FE(OH)2+	0.930	AL(SO4)2-	0.929
HS-	0.927	CAHCO3+	0.931	FE(OH)4-	0.930	ALF++	0.749
S--	0.747	MGHCO3+	0.928	FES04+	0.929	ALF2+	0.930
H5O4-	0.929	CAOH+	0.931	FECL++	0.747	ALF4-	0.929
SO4--	0.742	MGOH+	0.931	FECL2+	0.929	ALF5--	0.745
NASO4-	0.930	NH4+	0.926	FECL4-	0.928	ALF6---	0.515

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-8.140	MG++	0.28	-4.933	FE(OH)3	0.00	0.000
OH-	0.03	-5.720	NACL	0.01	-6.774	FE(OH)4-	0.00	0.000
H4SiO4	51.85	-3.268	KCL	0.00	-8.221	FECL+	0.00	0.000
H3SiO4-	1.06	-4.952	NASO4-	0.25	-5.684	FECL2	0.00	0.000
H2SiO4--	0.00	-8.397	KSO4-	0.04	-6.531	FECL++	0.00	0.000
NAH3SiO4-	0.03	-6.562	CASO4	0.78	-5.240	FECL2+	0.00	0.000
H3RO3	0.26	-5.370	MGSO4	0.12	-5.989	FECL3	0.00	0.000
H2RO3-	0.02	-6.443	CACO3	0.03	-6.582	FECL4-	0.00	0.000
H2CO3	0.32	-5.289	MGCO3	0.00	-7.768	FES04	0.00	0.000
HCO3-	19.59	-3.493	CAHCO3+	0.03	-6.477	FES04+	0.00	0.000
CO3--	0.16	-5.583	MGHCO3+	0.00	-7.467	AL+++	0.00	0.000
H2S	0.02	-6.288	CAOH+	0.00	-8.531	ALOH++	0.00	0.000
HS-	0.24	-5.130	MGOH+	0.00	-8.555	AL(OH)2+	0.00	0.000
S--	0.00	-13.917	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-20.402	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
H5O4-	0.00	-9.315	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	74.02	-3.113	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.750	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	3.15	-3.780	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	114.28	-2.492	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	47.34	-2.686	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	2.79	-4.147	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	4.85	-3.918	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00474

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.00239605
ANIONS (MOL.EQ.) 0.0052788
DIFFERENCE (%) -75.11

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.32

QUARTZ	82.7
CHALCEDONY	52.8
NAK	149.0

OXIDATION POTENTIAL (VOLTS) :
EH H2S= -0.285 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-20.979	99.999	ALBITE LOW	-19.889	99.999	ANALCIME	-15.803	99.999
ANHYDRITE	-4.739	-7.284	CALCITE	-8.454	-9.753	CHALCEDONY	-3.516	-3.268
MG-CHLORITE	-84.709	99.999	FLUORITE	-10.907	-11.668	GOETHITE	-8.900	99.999
LAUMONDITE	-31.912	99.999	MICROCLINE	-22.958	99.999	MAGNETITE	-33.533	99.999
CA-MONTHOR.	-108.402	99.999	K-MONTHOR.	-54.374	99.999	MG-MONTHOR.	-109.080	99.999
NA-MONTHOR.	-53.659	99.999	MUSCOVITE	-26.834	99.999	PREHNITE	-40.737	99.999
PYRRHOTITE	2.007	99.999	PYRITE	-53.760	99.999	QUARTZ	-3.944	-3.268
WAIRAKITE	-27.605	99.999	WOLLASTONITE	12.902	8.970	ZOISITE	-39.281	99.999
EPIDOTE	-149.217	99.999						

ORKUSTOFNUN JHD
1980-11-14 HORDUR

MADAGASCAR

8004050068

SOURCE DE MAFANA, FIANARANTSOA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

PH/DEG.C	8.20/18.0
SI02	50.40
NA	82.20
K	3.70
CA	69.70
MG	0.180
CO2	32.00
SO4	324.70
H2S	0.17
CL	9.90
F	3.66
DISS.SOLIDS	0.00
AL	0.0000
B	0.0600
FE	0.0000
NH3	0.0000
*	
*	
*	

STEAM SAMPLE

GAS (VOL.Z)	
CO2	
H2S	
H2	
O2	
CH4	
N2	

REFERENCE TEMP. DEGREES C 48.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/KG
DISCHARGE KG/SEC. 1.0

MEASURED TEMPERATURE DEGREES C 48.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

CONDENSATE (PPM)			
PH/DEG.C			
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
H2	0.0	0.0	0.0
CH4	0.0	0.0	0.0
N2	0.0	0.0	0.0
NA	0.0	0.0	0.0

CONDENSATE WITH NAOH (PPM)

CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.01183

IONIC BALANCE : CATIONS (MOL.EQ.)0.00672741
ANIONS (MOL.EQ.)0.00753074
DIFFERENCE (%) -11.27

DEEP WATER (PPM)

SI02	50.40
NA	82.20
K	3.70
CA	69.70
MG	0.180
SO4	324.69
CL	9.90
F	3.66
DISS.S.	0.00
AL	0.0000
B	0.0600
FE	0.0000

DEEP STEAM (PPM)

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.873E-03
H2S	0.672E-05
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.111E+00
TOTAL	0.112E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.905	KSO4-	0.895	FE++	0.650	FECL+	0.891
OH-	0.890	F-	0.890	FE+++	0.411	AL+++	0.411
H3SI04-	0.891	CL-	0.888	FEOH+	0.894	ALOH++	0.645
H2SI04--	0.645	NA+	0.891	FE(OH)3-	0.894	AL(OH)2+	0.895
H2BO3-	0.886	K+	0.888	FE(OH)4--	0.642	AL(OH)4-	0.893
HCO3-	0.891	CA++	0.650	FEOH++	0.642	ALSO4+	0.893
CO3--	0.637	MG++	0.666	FE(OH)2+	0.895	AL(SO4)2-	0.893
HS-	0.890	CAHCO3+	0.897	FE(OH)4-	0.895	ALF++	0.645
S--	0.642	MGHCO3+	0.891	FES04+	0.894	ALF2+	0.895
HSO4-	0.893	CAOH+	0.897	FECL+	0.642	ALF4-	0.893
SO4--	0.633	MGOH+	0.899	FECL2+	0.894	ALF5---	0.637
NASO4-	0.895	NH4+	0.886	FECL4-	0.891	ALF6----	0.353

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.832	MG++	0.12	-5.294	FE(OH)3	0.00	0.000
OH-	0.06	-5.435	NACL	0.00	-7.389	FE(OH)4-	0.00	0.000
H4SI04	78.75	-3.087	KCL	0.00	-9.082	FECL+	0.00	0.000
H3SI04-	1.79	-4.725	NASO4-	1.87	-4.804	FECL2	0.00	0.000
H2SI04--	0.00	-8.145	KSO4-	0.24	-5.757	FECL++	0.00	0.000
NAH3SI04-	0.08	-6.155	CASO4	35.87	-3.579	FECL2+	0.00	0.000
H3BO3	0.32	-5.280	MGSO4	0.27	-5.642	FECL3	0.00	0.000
H2BO3-	0.02	-6.513	CACO3	0.60	-5.225	FECL4-	0.00	0.000
H2CO3	1.18	-4.722	MGCO3	0.00	-7.945	FES04	0.00	0.000
HCO3-	41.78	-3.164	CAHCO3+	1.34	-4.878	FES04+	0.00	0.000
CO3--	0.25	-5.384	MGHCO3+	0.00	-7.494	AL+++	0.00	0.000
H2S	0.01	-6.399	CAOH+	0.00	-7.141	ALOH++	0.00	0.000
HS-	0.15	-5.338	MGOH+	0.00	-8.579	AL(OH)2+	0.00	0.000
S--	0.00	-14.082	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-18.683	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.205	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	297.48	-2.509	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.231	FEOH+	0.00	0.000	ALF++	0.00	0.000
F-	3.66	-3.715	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	9.90	-3.554	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	81.82	-2.447	FE(OH)4-	0.00	0.000	ALF4-	0.00	0.000
K+	3.63	-4.032	FE(OH)++	0.00	0.000	ALF5---	0.00	0.000
CA++	58.37	-2.837	FE(OH)2+	0.00	0.000	ALF6----	0.00	0.000

IONIC STRENGTH = 0.01155

IONIC BALANCE : CATIONS (MOL.EQ.)0.00658787
ANIONS (MOL.EQ.)0.00738601
DIFFERENCE (%) -11.42

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.11

QUARTZ	101.2
CHALCEDONY	71.3
NAK	126.0

OXIDATION POTENTIAL (VOLTS) :

EH H2S= -0.297 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

ADULARIA	TEOR. -19.691	CALC. 99.999	ALBITE LOW	TEOR. -18.718	CALC. 99.999	ANALCIME	TEOR. -14.891	CALC. 99.999
ANHYDRITE	-4.945	-5.732	CALCITE	-8.639	-8.603	CHALCEDONY	-3.306	-3.087
MG-CHLORITE	-82.846	99.999	FLUORITE	-10.730	-10.556	GOETHITE	-8.068	99.999
LAUMONDITE	-30.272	99.999	MICROCLINE	-21.478	99.999	MAGNETITE	-31.943	99.999
CA-MONTHOR.	-100.836	99.999	K-MONTHOR.	-50.250	99.999	MG-MONTHOR.	-101.666	99.999
NA-MONTHOR.	-49.688	99.999	MUSCOVITE	-24.943	99.999	PREHNITE	-39.250	99.999
PYRRHOTITE	1.746	99.999	PYRITE	-50.403	99.999	QUARTZ	-3.660	-3.087
WAIRAKITE	-26.542	99.999	WOLLASTONITE	12.052	9.553	ZOISITE	-38.003	99.999
EPIDOTE	-145.821	99.999						

ORKUSTOFNUN JHD
1980-11-14 HORDUR

MADAGASCAR

0004070072

SOURCE D'ANTSIRA, TOLIARY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	8.59/28.0
SI02	106.90
NA	625.10
K	44.80
CA	111.50
MG	0.900
CO2	35.90
SO4	204.00
H2S	0.20
CL	1169.20
F	6.36
DISS.SOLIDS	0.00
AL	0.0000
B	2.1300
FE	0.0000
NH3	0.0000
*	
*	
*	

GAS (VOL.Z)	
CO2	
H2S	
H2	
O2	
CH4	
N2	

REFERENCE TEMP. DEGREES C 51.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY KJOUL/KG
DISCHARGE KG/SEC. 2.5

MEASURED TEMPERATURE DEGREES C 51.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

CONDENSATE (PPM)	
PH/DEG.C	
CO2	0.0
H2S	0.0
NA	0.0

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0

CONDENSATE WITH NAOH (PPM)
CO2
H2S

IONIC STRENGTH = 0.04045

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.03354659
ANIONS (MOL.EQ.) 0.03813150
DIFFERENCE (%) -12.79

DEEP WATER (PPM)

SI02	106.91
NA	625.10
K	44.80
CA	111.50
MG	0.900
SO4	204.00
CL	1169.10
F	6.36
DISS.S.	0.00
AL	0.0000
B	2.1298
FE	0.0000

CO2	35.90
H2S	0.20
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

DEEP STEAM (PPM)

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.365E-03
H2S	0.302E-05
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.129E+00
TOTAL	0.130E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.855	KSO4-	0.832	FE++	0.495	* FECL+	0.821
OH-	0.817	F-	0.817	FE+++	0.252	AL+++	0.252
H3SI04-	0.821	CL-	0.812	FE0H+	0.829	ALOH++	0.485
H2SI04--	0.485	NA+	0.821	FE(OH)3-	0.829	AL(OH)2+	0.832
H2BO3-	0.808	K+	0.812	FE(OH)4--	0.478	AL(OH)4-	0.825
HCO3-	0.821	CA++	0.495	FE0H++	0.478	ALSO4+	0.825
CO3--	0.469	MG++	0.526	FE(OH)2+	0.832	AL(SO4)2-	0.825
HS-	0.817	CANCO3+	0.836	FE(OH)4-	0.832	ALF++	0.485
S--	0.478	MGHCO3+	0.821	FES04+	0.829	ALF2+	0.832
H5O4-	0.825	CADH+	0.836	FECL++	0.478	ALF4-	0.825
SO4--	0.460	MGOH+	0.840	FECL2+	0.829	ALF5--	0.469
NASO4-	0.832	NH4+	0.803	FECL4-	0.821	ALF6---	0.183

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

HI (ACT.)	0.00	-8.236	MG++	0.76	-4.504	FE(OH)3	0.00	0.000
OH-	0.21	-4.917	NACL	1.98	-4.470	FE(OH)4-	0.00	0.000
H4SI04	157.37	-2.786	KCL	0.08	-5.981	FECL+	0.00	0.000
H3SI04-	10.89	-3.941	NASO4-	6.49	-4.263	FECL2	0.00	0.000
H2SI04--	0.01	-6.833	KSO4-	1.32	-5.011	FECL++	0.00	0.000
NAH3SI04-	3.23	-4.563	CASO4	22.32	-3.785	FECL2+	0.00	0.000
H3BO3	10.42	-3.773	MGSO4	0.64	-5.274	FECL3	0.00	0.000
H2BO3-	1.73	-4.545	CACO3	2.28	-4.642	FECL4-	0.00	0.000
H2CO3	0.46	-5.126	MGCO3	0.01	-6.818	FES04	0.00	0.000
HCO3-	45.72	-3.125	CANCO3+	2.12	-4.678	FES04+	0.00	0.000
CO3--	0.09	-4.830	MGHCO3+	0.01	-6.757	AL+++	0.00	0.000
H2S	0.01	-6.770	CADH+	0.02	-6.487	ALOH++	0.00	0.000
HS-	0.19	-5.244	MGOH+	0.00	-7.365	AL(OH)2+	0.00	0.000
S--	0.00	-13.451	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-19.761	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
H5O4-	0.00	-8.889	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	181.56	-2.724	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.406	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	6.36	-3.475	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	1167.86	-1.482	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	622.44	-1.567	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	44.38	-2.945	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	103.16	-2.589	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.04023

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.03344116
ANIONS (MOL.EQ.) 0.03799881
DIFFERENCE (%) -12.76

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.08

QUARTZ	136.4
CHALCEDONY	107.0
NAK	165.0

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.335 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-19.513	99.999	ALBITE LOW	-18.557	99.999	ANALCIME	-14.763	99.999
ANHYDRITE	-4.978	-5.955	CALCITE	-8.671	-8.053	CHALCEDONY	-3.276	-2.786
MG-CHLORITE	-82.605	99.999	FLUORITE	-10.709	-10.021	GOETHITE	-7.946	99.999
LAUMONITE	-30.045	99.999	MICROCLINE	-21.273	99.999	MAGNETITE	-31.711	99.999
CA-MONTHOR.	-99.756	99.999	K-MONTHOR.	-49.665	99.999	MG-MONTHOR.	-100.607	99.999
NA-MONTHOR.	-49.125	99.999	MUSCOVITE	-24.676	99.999	PREHNITE	-39.054	99.999
PYRRHOTITE	1.711	99.999	PYRITE	-49.928	99.999	QUARTZ	-3.621	-2.786
WAIKAKITE	-26.396	99.999	WOLLASTONITE	11.934	10.791	ZOISITE	-37.834	99.999
EPIDOTE	-145.380	99.999						

ORKUSTOFNUN JHD
1980-11-14 HORDUR

MADAGASCAR

8004070073

SOURCE DE KIPOSA, TOLIARY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPH)

STEAM SAMPLE

PH/DEG.C	7.80/27.5
SI02	42.40
NA	231.20
K	12.70
CA	99.50
MG	3.600
CO2	63.00
SO4	81.90
H2S	0.00
CL	330.50
F	5.05
DISS.SOLIDS	0.00
AL	0.0000
B	1.0900
FE	0.0000
NH3	0.0000
H2S	<0.1
*	
*	

GAS (VOL.Z)

CO2	
H2S	
H2	
O2	
CH4	
N2	

REFERENCE TEMP. DEGREES C 30.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY KJ/OL/KG
DISCHARGE KG/SEC. 2.0

MEASURED TEMPERATURE DEGREES C 30.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

MEASURED DOWNHOLE TEMP. FLUID INFLOW
DEGREES C/METERS DEPTH (METERS)

CONDENSATE (PPH)
PH/DEG.C /

CONDENSATE WITH NAOH (PPH)
CO2
H2S

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0

IONIC STRENGTH = 0.01725

IONIC BALANCE : CATIONS (MOL.EQ.)0.01543201
ANIONS (MOL.EQ.)0.01248649
DIFFERENCE (%) 21.10

DEEP WATER (PPH)

DEEP STEAM (PPH)

GAS PRESSURES (BARS ABS.)

SI02	42.40
NA	231.20
K	12.70
CA	99.50
MG	3.600
SO4	81.90
CL	330.47
F	5.05
DISS.S.	0.00
AL	0.0000
B	1.0899
FE	0.0000

CO2	63.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00
H2O	0.423E-01
TOTAL	0.437E-01

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.893	KS04-	0.881	FE++	0.610	FECL+	0.875
OH-	0.873	F-	0.873	FE+++	0.366	AL+++	0.366
H3SI04-	0.875	CL-	0.870	FE0H+	0.879	AL0H+	0.604
H2SI04--	0.604	NA+	0.875	FE(OH)3--	0.879	AL(OH)2+	0.881
H2BO3-	0.868	K+	0.870	FE(OH)4---	0.600	AL(OH)4-	0.877
HCO3-	0.875	CA++	0.610	FE0H++	0.600	ALSO4+	0.877
CO3--	0.594	MG++	0.630	FE(OH)2+	0.881	AL(SO4)2-	0.877
HS-	0.873	CAHCO3+	0.883	FE(OH)4-	0.881	ALF++	0.604
S--	0.600	MGHCO3+	0.875	FESO4+	0.879	ALF2+	0.881
HSD4-	0.877	CAOH+	0.883	FECL++	0.600	ALF4-	0.877
SO4--	0.589	MGOH+	0.885	FECL2+	0.879	ALF5---	0.594
NASO4-	0.881	NH4+	0.868	FECL4-	0.875	ALF6---	0.311

CHEMICAL COMPONENTS IN DEEP WATER (PPH AND LOG MOLE)

HI (ACT.)	0.00	-7.780	MG++	3.35	-3.860	FE(OH)3	0.00	0.000
OH-	0.02	-5.991	NACL	0.13	-5.656	FE(OH)4-	0.00	0.000
H4SI04	67.05	-3.156	KCL	0.01	-7.145	FECL+	0.00	0.000
H3SI04-	0.69	-5.138	NASO4-	0.96	-5.092	FECL2	0.00	0.000
H2SI04--	0.00	-8.843	KS04-	0.14	-5.971	FECL++	0.00	0.000
NAH3SI04-	0.09	-6.114	CASO4	10.04	-4.132	FECL2+	0.00	0.000
H3BO3	5.99	-4.014	MCSO4	1.00	-5.079	FECL3	0.00	0.000
H2BO3-	0.24	-5.404	CACO3	0.78	-5.106	FECL4-	0.00	0.000
H2CO3	2.84	-4.339	MCCO3	0.03	-6.513	FESO4	0.00	0.000
HCO3-	82.18	-2.871	CANCO3+	2.38	-4.628	FESO4+	0.00	0.000
CO3--	0.35	-5.232	MGHCO3+	0.12	-5.847	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-7.594	ALOH++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-7.827	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-19.729	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSD4-	0.00	-9.011	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	73.14	-3.118	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.195	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	5.05	-3.575	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	330.39	-2.031	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	230.95	-1.998	FE(OH)4---	0.00	0.000	ALF4-	0.00	0.000
K+	12.65	-3.490	FE(OH)++	0.00	0.000	ALF5---	0.00	0.000
CA++	95.29	-2.624	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01723

IONIC BALANCE : CATIONS (MOL.EQ.)0.01542494
ANIONS (MOL.EQ.)0.01247917
DIFFERENCE (%) 21.11

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.30

QUARTZ	93.9
CHALCEDONY	63.9
NAK	142.6

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

ADULARIA	TEOR. -20.840	CALC. 99.999	ALBITE LOW	TEOR. -19.763	CALC. 99.999	ANALCINE	TEOR. -15.707	CALC. 99.999
ANHYDRITE	TEOR. -4.758	CALC. -6.187	CALCITE	TEOR. -8.470	CALC. -8.297	CHALCEDONY	TEOR. -3.494	CALC. -3.156
MG-CHLORITE	TEOR. -84.502	CALC. 99.999	FLUORITE	TEOR. -10.086	CALC. -10.108	GOETHITE	TEOR. -8.815	CALC. 99.999
LAUMONDITE	TEOR. -31.736	CALC. 99.999	MICROCLINE	TEOR. -22.800	CALC. 99.999	MAGNETITE	TEOR. -33.370	CALC. 99.999
CA-MONTHOR.	TEOR. -107.607	CALC. 99.999	K-MONTHOR.	TEOR. -53.940	CALC. 99.999	MG-MONTHOR.	TEOR. -108.305	CALC. 99.999
NA-MONTHOR.	TEOR. -53.243	CALC. 99.999	MUSCOVITE	TEOR. -26.634	CALC. 99.999	PREHNITE	TEOR. -40.572	CALC. 99.999
PYRRHOTITE	TEOR. 1.979	CALC. 99.999	PYRITE	TEOR. -53.409	CALC. 99.999	QUARTZ	TEOR. -3.914	CALC. -3.156
WAIRAKITE	TEOR. -27.490	CALC. 99.999	WOLLASTONITE	TEOR. 12.812	CALC. 9.564	ZOISITE	TEOR. -39.138	CALC. 99.999
EPIDOTE	TEOR. -148.839	CALC. 99.999						

ORKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

8004270080

RANOMAFANA VOHITSARA, TOMASINA, MADAGASCAR.

PROGRAM MATCH2.

WATER SAMPLE (PPH)

STEAM SAMPLE

PH/DEG.C	9.28/28.0
SI02	75.00
NA	123.30
K	4.00
CA	8.20
MG	0.590
CO2	27.40
SO4	159.30
H2S	0.17
CL	73.00
F	4.40
DISS.SOLIDS	0.00
AL	0.0000
B	0.0500
FE	0.0000
NH3	0.0000

GAS (VOL.Z)	
CO2	
H2S	
H2	
O2	
CH4	
N2	

REFERENCE TEMP. DEGREES C 38.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/OL/KG
DISCHARGE KG/SEC. 1.0

MEASURED TEMPERATURE DEGREES C 38.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

CONDENSATE (PPH)	
PH/DEG.C	
CO2	
H2S	
NA	

CONDENSATE WITH NAOH (PPH)	
CO2	
H2S	

IONIC STRENGTH = 0.00808

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.00583032
ANIONS (MOL.EQ.) 0.00653933
DIFFERENCE (%) -11.33

DEEP WATER (PPH)

DEEP STEAM (PPH)

GAS PRESSURES (BARS ABS.)

SI02	75.01
NA	123.30
K	4.00
CA	8.20
MG	0.590
SO4	159.30
CL	72.99
F	4.40
DISS.S.	0.00
AL	0.0000
B	0.0500
FE	0.0000

CO2	27.40
H2S	0.17
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

CO2	0.320E-04
H2S	0.390E-06
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.661E-01
TOTAL	0.661E-01

H2O (Z) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.918	KSO4-	0.911	FE++	0.695	FECL+	0.908
OH-	0.907	F-	0.907	FE+++	0.467	AL+++	0.467
H3SI04-	0.908	CL-	0.906	FE(OH)+	0.910	AL(OH)++	0.691
H2SI04--	0.691	NA+	0.908	FE(OH)3-	0.910	AL(OH)2+	0.911
H2BO3-	0.904	K+	0.906	FE(OH)4--	0.688	AL(OH)4-	0.909
HCO3-	0.908	CA++	0.695	FE(OH)+	0.688	ALSO4+	0.909
CO3--	0.685	MG++	0.707	FE(OH)2+	0.911	AL(SO4)2-	0.909
HS-	0.907	CANCO3+	0.912	FE(OH)4-	0.911	ALF++	0.691
S--	0.688	MGHCO3+	0.908	FESO4+	0.910	ALF2+	0.911
H2SO4-	0.909	CAOH+	0.912	FECL++	0.688	ALF4-	0.909
SO4--	0.681	NGOH+	0.913	FECL2+	0.910	ALF5--	0.685
NASO4-	0.911	NH4+	0.904	FECL4-	0.908	ALF6--	0.427

CHEMICAL COMPONENTS IN DEEP WATER (PPH AND LOG MOLE)

H+ (ACT.)	0.00	-9.108	NG++	0.47	-4.711	FE(OH)3	0.00	0.000
OH-	0.62	-4.440	NACL	0.02	-6.460	FE(OH)4-	0.00	0.000
H4SI04	91.23	-3.023	KCL	0.00	-8.221	FECL+	0.00	0.000
H3SI04-	26.73	-3.551	NASO4-	1.40	-4.930	FECL2	0.00	0.000
H2SI04--	0.13	-5.849	KSO4-	0.13	-6.029	FECL++	0.00	0.000
NAH3SI04-	1.96	-4.779	CASO4	2.32	-4.768	FECL2+	0.00	0.000
H3BO3	0.15	-5.624	MGSO4	0.49	-5.394	FECL3	0.00	0.000
H2BO3-	0.14	-5.648	CACO3	0.84	-5.075	FECL4-	0.00	0.000
H2CO3	0.05	-6.060	MGCO3	0.05	-6.252	FESO4	0.00	0.000
HCO3-	34.08	-3.253	CANCO3+	0.11	-5.975	FESO4+	0.00	0.000
CO3--	3.19	-4.275	MGHCO3+	0.01	-7.005	AL+++	0.00	0.000
H2S	0.00	-7.545	CAOH+	0.00	-7.075	ALOH++	0.00	0.000
HS-	0.16	-5.305	NGOH+	0.00	-7.027	AL(OH)2+	0.00	0.000
S--	0.00	-12.941	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-21.764	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
H2SO4-	0.00	-9.864	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	156.05	-2.789	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-9.502	FE(OH)+	0.00	0.000	ALF++	0.00	0.000
F-	4.40	-3.635	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	72.98	-2.686	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	122.64	-2.273	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	3.96	-3.994	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	7.13	-3.750	FE(OH)2+	0.00	0.000	ALF6--	0.00	0.000

IONIC STRENGTH = 0.00806

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.00583201
ANIONS (MOL.EQ.) 0.00653142
DIFFERENCE (%) -11.31

1000/T DEGREES KELVIN = 3.21

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	108.2
CHALCEDONY	78.3
NAK	103.1

OXIDATION POTENTIAL (VOLTS) :
EH H2S= -0.368
EH CH4= 99.999
EH H2= 99.999
EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.			
ADULARIA	-20.310	99.999	ALBITE LOW	-19.281	99.999	ANALCIME	-15.333	99.999
ANHYDRITE	-4.838	-6.864	CALCITE	-8.540	-8.347	CHALCEDONY	-3.408	-3.023
MG-CHLORITE	-83.720	99.999	FLUORITE	-10.809	-11.263	GOETHITE	-8.479	99.999
LAUNONDITE	-31.061	99.999	MICROCLINE	-22.191	99.999	MAGNETITE	-32.727	99.999
CA-MONTHOR.	-104.527	99.999	K-MONTHOR.	-52.258	99.999	MG-MONTHOR.	-105.287	99.999
NA-MONTHOR.	-51.624	99.999	MUSCOVITE	-25.860	99.999	PREHNITE	-39.953	99.999
PYRRHOTITE	1.871	99.999	PYRITE	-52.040	99.999	QUARTZ	-3.798	-3.023
MAIRAKITE	-27.051	99.999	WOLLASTONITE	12.463	11.285	ZOISITE	-38.604	99.999
EPIDOTE	-147.415	99.999						

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

8005110083

RANOMAFANA - DOANY, ANTSIRANANA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	7.62/23.0
SiO2	64.10
NA	279.20
K	10.80
CA	19.10
Mg	3.720
CO2	476.30
SO4	104.80
H2S	0.20
CL	46.50
F	6.50
DISS.SOLIDS	0.00
AL	0.0000
B	0.0800
FE	0.0000
NH3	0.0000
*	
*	
*	

GAS (VOL.Z)	REFERENCE TEMP.	DEGREES C	59.0 (MEASURED)
CO2	SAMPLING PRESSURE	BARS ABS.	
H2S	DISCHARGE ENTHALPY	KJ/OL/KG	
H2	DISCHARGE	KG/SEC.	5.0
O2	MEASURED TEMPERATURE	DEGREES C	59.0
CH4	RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0
N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C

MEASURED DOWNHOLE TEMP.
DEGREES C/METERS

CONDENSATE (PPM)	0.0	0.0	0.0
PH/DEG.C	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
NA	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0

CONDENSATE WITH MAOH (PPM)

CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.01543

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01355963
ANIONS (MOL.EQ.) 0.01402778
DIFFERENCE (%) -3.39

DEEP WATER (PPM)

SiO2	64.11
NA	279.20
K	10.80
CA	19.10
Mg	3.720
SO4	104.80
CL	46.50
F	6.50
DISS.S.	0.00
AL	0.0000
B	0.0800
FE	0.0000

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

CO2	476.30	CO2	0.00	CO2	0.327E-01
H2S	0.20	H2S	0.00	H2S	0.157E-04
H2	0.00	H2	0.00	H2	0.000E+00
O2	0.00	O2	0.00	O2	0.000E+00
CH4	0.00	CH4	0.00	CH4	0.000E+00
N2	0.00	N2	0.00	N2	0.000E+00
NH3	0.00	NH3	0.00	NH3	0.000E+00
				H2O	0.190E+00
				TOTAL	0.223E+00

H2O (%)	0.00
BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.893	KSO4-	0.881	FE++	0.611	FECL+	0.876
OH-	0.873	F-	0.873	FE+++	0.366	AL+++	0.366
H3SI04-	0.876	CL-	0.871	FEOH+	0.879	ALOH++	0.605
H2SI04--	0.605	NA+	0.876	FE(OH)3-	0.879	AL(OH)2+	0.881
H2BO3-	0.869	K+	0.871	FE(OH)4--	0.601	AL(OH)4-	0.878
HCO3-	0.876	CA++	0.611	FEOH++	0.601	ALSO4+	0.878
CO3--	0.596	MG++	0.630	FE(OH)2+	0.881	AL(SO4)2-	0.878
HS-	0.873	CAHCO3+	0.883	FE(OH)4-	0.881	ALF++	0.605
S--	0.601	MGHCO3+	0.876	FES04+	0.879	ALF2+	0.881
HSO4-	0.878	CAOH+	0.883	FECL++	0.601	ALF4-	0.878
SO4--	0.590	MGOH+	0.885	FECL2+	0.879	ALF5--	0.596
NASO4-	0.881	NH4+	0.869	FECL4-	0.876	ALF6---	0.312

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG HOLE)

H+ (ACT.)	0.00	-7.506	MG++	2.89	-3.925	FE(OH)3	0.00	0.000
OH-	0.05	-5.482	NACL	0.05	-6.053	FE(OH)4-	0.00	0.000
H4SI04	100.77	-2.979	KCL	0.00	-7.887	FECL+	0.00	0.000
H3SI04-	1.56	-4.784	NASO4-	2.25	-4.723	FECL2	0.00	0.000
H2SI04--	0.00	-8.387	KSO4-	0.25	-5.730	FECL++	0.00	0.000
NAH3SI04-	0.23	-5.705	CASO4	3.13	-4.639	FECL2+	0.00	0.000
H3BO3	0.44	-5.144	MGSO4	2.47	-4.687	FECL3	0.00	0.000
H2BO3-	0.01	-6.639	CACO3	1.44	-4.841	FECL4-	0.00	0.000
H2CO3	35.58	-3.241	MGCO3	0.19	-5.653	FES04	0.00	0.000
HCO3-	617.71	-1.995	CAHCO3+	6.51	-4.191	FES04+	0.00	0.000
CO3--	2.01	-4.475	MGHCO3+	0.97	-4.943	AL+++	0.00	0.000
H2S	0.03	-6.115	CAOH+	0.00	-7.754	ALOH++	0.00	0.000
HS-	0.17	-5.292	MGOH+	0.00	-7.227	AL(OH)2+	0.00	0.000
S--	0.00	-14.190	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-18.238	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.239	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	98.62	-2.989	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.569	FEOH+	0.00	0.000	ALF++	0.00	0.000
F-	6.50	-3.466	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	46.46	-2.882	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	278.70	-1.916	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	10.73	-3.562	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	15.02	-3.426	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01524

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01345987
ANIONS (MOL.EQ.) 0.01392117
DIFFERENCE (%) -3.37

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.01

QUARTZ	113.0
CHALCEDONY	83.2
NAK	115.3

OXIDATION POTENTIAL (VOLTS) :
EH H2S= -0.298 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

ADULARIA	TEOR.	CALC.	ALBITE LOW	TEOR.	CALC.	ANALCIME	TEOR.	CALC.
ANHYDRITE	-19.056	99.999	CALCITE	-18.141	99.999	CHALCEDONY	-14.433	99.999
Mg-CHLORITE	-5.071	-6.858	FLUORITE	-8.760	-8.340	GOETHITE	-3.199	-2.979
LAUMONDITE	-82.004	99.999	MICROCLINE	-10.661	-10.689	MAGNETITE	-7.624	99.999
CA-MONTHOR.	-29.459	99.999	K-MONTHOR.	-20.747	99.999	Mg-MONTHOR.	-31.098	99.999
NA-MONTHOR.	-96.926	99.999	MUSCOVITE	-48.129	99.999	PREHNITE	-97.816	99.999
PYRRHOTITE	-47.643	99.999	PYRITE	-23.981	99.999	QUARTZ	-38.554	99.999
WAIRAKITE	1.622	99.999	WOLLASTONITE	-48.696	99.999	ZOISITE	-3.519	-2.979
EPIDOTE	-26.020	99.999		11.629	8.392		-37.404	99.999
	-144.288	99.999						

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

8005110085

SOURCE ANDRANOMOLOLO - DOANY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	7.63/24.0
SI02	49.40
NA	121.60
K	4.90
CA	5.30
MG	1.400
CO2	146.40
SO4	30.80
H2S	0.17
CL	16.10
F	1.80
DISS.SOLIDS	0.00
AL	0.0000
R	0.0300
FE	0.0000
NH3	0.0000
*	
*	
*	

GAS (VOL.Z)	
CO2	
H2S	
H2	
O2	
CH4	
N2	

REFERENCE TEMP. DEGREES C 40.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/OL/KG
DISCHARGE KG/SEC. 0.5

MEASURED TEMPERATURE DEGREES C 40.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

CONDENSATE (PPM)	0.0	0.0	0.0
PH/DEG.C	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
NA	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0

CONDENSATE WITH NaOH (PPM)

CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.00556

IONIC BALANCE : CATIONS (MOL.EQ.) 0.00577758
ANIONS (MOL.EQ.) 0.00434651
DIFFERENCE (%) 28.27

DEEP WATER (PPM)

SI02	49.40
NA	121.60
K	4.90
CA	5.30
MG	1.400
SO4	30.80
CL	16.10
F	1.80
DISS.S.	0.00
AL	0.0000
R	0.0300
FE	0.0000

DEEP STEAM (PPM)

CO2	146.40
H2S	0.17
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.669E-02
H2S	0.118E-04
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.736E-01
TOTAL	0.803E-01

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.929	KSO4-	0.924	FE++	0.732	FECL+	0.922
OH-	0.921	F-	0.921	FE+++	0.518	AL+++	0.518
H3SI04-	0.922	CL-	0.920	FE0H+	0.923	ALOH++	0.730
H2SI04--	0.730	NA+	0.922	FE(OH)3-	0.923	AL(OH)2+	0.924
H2BO3-	0.919	K+	0.920	FE(OH)4--	0.728	AL(OH)4-	0.922
HCO3-	0.922	CA++	0.732	FE0H++	0.728	ALSO4+	0.922
CO3--	0.725	MG++	0.742	FE(OH)2+	0.924	AL(SO4)2-	0.922
HS-	0.921	CAHCO3+	0.925	FE(OH)4-	0.924	ALF++	0.730
S--	0.728	MGHCO3+	0.922	FESO4+	0.923	ALF2+	0.924
HSO4-	0.922	CAOH+	0.925	FECL++	0.728	ALF4-	0.922
SO4--	0.722	MGOH+	0.926	FECL2+	0.923	ALF5--	0.725
NASO4-	0.924	NH4+	0.919	FECL4-	0.922	ALF6---	0.485

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.559	MG++	1.29	-4.274	FE(OH)3	0.00	0.000
OH-	0.02	-5.939	NACL	0.00	-7.082	FE(OH)4-	0.00	0.000
H4SI04	78.29	-3.089	KCL	0.00	-8.761	FECL+	0.00	0.000
H3SI04-	0.69	-5.140	NASO4-	0.29	-5.613	FECL2	0.00	0.000
H2SI04--	0.00	-8.976	KSO4-	0.03	-6.615	FECL++	0.00	0.000
HAH3SI04-	0.05	-6.361	CASO4	0.36	-5.581	FECL2+	0.00	0.000
H3BO3	0.17	-5.568	MGSO4	0.30	-5.603	FECL3	0.00	0.000
H2BO3-	0.00	-7.136	CACO3	0.11	-5.969	FECL4-	0.00	0.000
H2CO3	10.79	-3.759	MGCO3	0.02	-6.564	FESO4	0.00	0.000
HCO3-	191.40	-2.504	CAHCO3+	0.47	-5.334	FESO4+	0.00	0.000
CO3--	0.50	-5.080	MGHCO3+	0.14	-5.792	AL+++	0.00	0.000
H2S	0.03	-6.084	CAOH+	0.00	-8.698	ALOH++	0.00	0.000
HS-	0.14	-5.380	MGOH+	0.00	-8.057	AL(OH)2+	0.00	0.000
S--	0.00	-14.554	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-19.299	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.986	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	30.05	-3.505	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.318	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	1.80	-4.023	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	16.10	-3.343	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	121.53	-2.277	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	4.89	-3.903	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	4.97	-3.907	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00555

IONIC BALANCE : CATIONS (MOL.EQ.) 0.00577181
ANIONS (MOL.EQ.) 0.00434029
DIFFERENCE (%) 28.31

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.19

QUARTZ	100.9
CHALCEDONY	71.0
NAK	118.7

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.269 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-20.182	99.999	ALBITE LOW	-19.165	99.999
ANHYDRITE	-4.858	-7.688	CALCITE	-8.559	-9.262
MG-CHLORITE	-83.537	99.999	FLUORITE	-10.792	-12.161
LAUMONDITE	-30.899	99.999	MICROCLINE	-22.044	99.999
CA-MONTMOR.	-103.773	99.999	K-MONTMOR.	-51.850	99.999
NA-MONTMOR.	-51.231	99.999	MUSCOVITE	-25.673	99.999
PYRRHOTITE	1.845	99.999	PYRITE	-51.706	99.999
WAIKAKITE	-26.946	99.999	WOLLASTONITE	12.378	7.986
EPIDOTE	-147.080	99.999			
			ANALCINE	-15.242	99.999
			CHALCEDONY	-3.387	-3.089
			GOETHITE	-8.396	99.999
			MAGNETITE	-32.569	99.999
			MG-MONTMOR.	-104.553	99.999
			PREHNITE	-39.806	99.999
			QUARTZ	-3.770	-3.089
			ZOISITE	-38.478	99.999

ORKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

8005140089

RANOMAFANA D'AMBODIANGEZOKA, ANTSTRANANA, MADAGASCAR.

PROGRAM MATCH2.

WATER SAMPLE (PPM)

PH/DEG.C	7.61/24.0
SI02	102.60
NA	328.30
K	20.90
CA	42.80
MG	4.300
CO2	344.00
SO4	322.60
H2S	0.17
CL	154.50
F	4.60
DISS.SOLIDS	0.00
AL	0.0000
B	0.1800
FE	0.0000
NH3	0.0000

STEAM SAMPLE

GAS (VOL.Z)	
CO2	
H2S	
H2	
O2	
CH4	
N2	

REFERENCE TEMP. DEGREES C 63.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY H.JOUL/KG
DISCHARGE KB/SEC. 10.0

MEASURED TEMPERATURE DEGREES C 63.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

LITERS GAS PER 'KG
CONDENSATE/DEG.C

CONDENSATE (PPM)	
PH/DEG.C	
CO2	
H2S	
NA	

CONDENSATE WITH NAOH (PPM)
CO2
H2S

IONIC STRENGTH = 0.02191

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01693114
ANIONS (MOL.EQ.) 0.01836990
DIFFERENCE (%) -8.15

DEEP WATER (PPM)

SI02	102.61
NA	328.30
K	20.90
CA	42.80
MG	4.300
SO4	322.59
CL	154.49
F	4.60
DISS.S.	0.00
AL	0.0000
B	0.1800
FE	0.0000

DEEP STEAM (PPM)

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.264E-01
H2S	0.142E-04
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.228E+00
TOTAL	0.255E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.879	KSO4-	0.863	FE++	0.567	FECL1	0.856
OH-	0.853	F-	0.853	FE+++	0.318	AL+++	0.318
H3SI04-	0.856	CL-	0.851	FE0H+	0.861	AL0H++	0.559
H2SI04--	0.559	NA+	0.856	FE(OH)3-	0.861	AL(OH)2+	0.863
H2BO3-	0.848	K+	0.851	FE(OH)4--	0.554	AL(OH)4-	0.859
HCO3-	0.856	CA++	0.567	FE0H++	0.554	ALSO4+	0.859
CO3---	0.548	MG++	0.590	FE(OH)2+	0.863	AL(SO4)2-	0.859
HS-	0.853	CAHCO3+	0.866	FE(OH)4-	0.863	ALF++	0.559
S---	0.554	MGHCO3+	0.856	FES04+	0.861	ALF2+	0.863
H5O4-	0.859	CAOH+	0.866	FECL++	0.554	ALF4-	0.859
SO4---	0.541	MGOH+	0.868	FECL2+	0.861	ALF5---	0.548
NASO4-	0.863	NH4+	0.848	FECL4-	0.856	ALF6---	0.259

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

HI (ACT.)	0.00	-7.476	NG++	2.74	-3.949	FE(OH)3	0.00	0.000
OH-	0.07	-5.410	NACL	0.22	-5.429	FE(OH)4-	0.00	0.000
H4SI04	161.06	-2.776	KCL	0.01	-7.080	FECL+	0.00	0.000
H3SI04-	2.68	-4.550	NASO4-	7.64	-4.192	FECL2	0.00	0.000
H2SI04--	0.00	-8.119	KSO4-	1.40	-4.985	FECL++	0.00	0.000
NAH3SI04-	0.45	-5.424	CASO4	18.33	-3.871	FECL2+	0.00	0.000
H3BO3	1.00	-4.792	MGSO4	6.67	-4.256	FECL3	0.00	0.000
H2BO3-	0.03	-6.289	CACO3	2.15	-4.668	FECL4-	0.00	0.000
H2CO3	26.65	-3.367	MCCO3	0.12	-5.854	FES04	0.00	0.000
HCO3-	441.15	-2.141	CAHCO3+	10.35	-3.990	FES04+	0.00	0.000
CO3---	1.46	-4.613	MGHCO3+	0.64	-5.128	AL+++	0.00	0.000
H2S	0.02	-6.191	CAOH+	0.00	-7.363	AL0H++	0.00	0.000
HS-	0.14	-5.362	MGOH+	0.00	-7.189	AL(OH)2+	0.00	0.000
S---	0.00	-14.211	MH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.630	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
H5O4-	0.00	-7.706	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4---	297.17	-2.510	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.664	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	4.60	-3.616	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	154.35	-2.361	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	326.65	-1.847	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	20.49	-3.281	FE(OH)++	0.00	0.000	ALF5---	0.00	0.000
CA++	32.44	-3.092	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.02143

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01668613
ANIONS (MOL.EQ.) 0.01809800
DIFFERENCE (%) -8.12

1000/T DEGREES KELVIN = 2.97

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	137.7
CHALCEDONY	108.4
NAK	154.0

OXIDATION POTENTIAL (VOLTS) :

EH H2S= -0.299 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-18.836	99.999	ALBITE LOW	-17.941	99.999
ANHYDRITE	-5.119	-6.115	CALCITE	-8.808	-8.213
MG-CHLORITE	-81.727	99.999	FLUORITE	-10.641	-10.708
LAUMONDITE	-29.175	99.999	MICROCLINE	-20.492	99.999
CA-MONTHOR.	-95.531	99.999	K-MONTHOR.	-47.376	99.999
NA-MONTHOR.	-46.915	99.999	MUSCOVITE	-23.643	99.999
PYRRHOTITE	1.580	99.999	PYRITE	-48.098	99.999
WAIRAKITE	-25.838	99.999	WOLLASTONITE	11.483	8.838
EPIDOTE	-143.784	99.999			
			ANALCIME	-14.272	99.999
			CHALCEDONY	-3.162	-2.776
			GOETHITE	-7.464	99.999
			MAGNETITE	-30.794	99.999
			MG-MONTHOR.	-96.443	99.999
			PREHNITE	-38.316	99.999
			QUARTZ	-3.470	-2.776
			ZOISITE	-37.198	99.999

ORKUSTOFNUM JHD
1980-11-14 NORDUR

MADAGASCAR

8005070093

SOURCE DE SOATANINDARY, TOLIARY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

PH/DEG.C	7.84/27.0
SI02	55.30
NA	242.90
K	7.50
CA	6.70
MG	0.160
CO2	93.70
SO4	67.50
H2S	0.00
CL	296.50
F	13.10
DISS.SOLIDS	0.00
AL	0.0000
B	0.1900
FE	0.0000
NH3	0.0000
H2S	<0.1
*	
*	

STEAM SAMPLE

GAS (VOL.%)
CO2
H2S
H2
O2
CH4
N2

REFERENCE TEMP. DEGREES C 45.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/OL/KG
DISCHARGE KG/SEC. 2.0

MEASURED TEMPERATURE DEGREES C 45.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EN/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

CONDENSATE (PPM)	0.0	0.0	0.0
PH/DEG.C	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
NA	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0

CONDENSATE WITH NAOH (PPM)	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.01266

IONIC BALANCE : CATIONS (MOL.EQ.)0.01107838
ANIONS (MOL.EQ.)0.01251105
DIFFERENCE (%) -12.15

DEEP WATER (PPM)

SI02	55.30
NA	242.90
K	7.50
CA	6.70
MG	0.160
SO4	67.50
CL	296.47
F	13.10
DISS.S.	0.00
AL	0.0000
B	0.1900
FE	0.0000

DEEP STEAM (PPM)

CO2	93.70
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.309E-02
H2S	0.000E+00
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.957E-01
TOTAL	0.988E-01

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.902	KSO4-	0.892	FE++	0.641	FECL+	0.888
OH-	0.886	F-	0.886	FE+++	0.400	AL+++	0.400
H3SI04-	0.888	CL-	0.884	FE(OH)+	0.891	AL(OH)+	0.636
H2SI04--	0.636	NA+	0.888	FE(OH)3-	0.891	AL(OH)2+	0.892
H2BO3-	0.882	K+	0.884	FE(OH)4--	0.632	AL(OH)4-	0.889
HCO3-	0.888	CA++	0.641	FE(OH)+	0.632	ALSO4+	0.889
CO3--	0.628	MG++	0.658	FE(OH)2+	0.892	AL(SO4)2-	0.889
HS-	0.886	CAHCO3+	0.894	FE(OH)4-	0.892	ALF++	0.636
S--	0.632	MGNCO3+	0.888	FESO4+	0.891	ALF2+	0.892
H2SO4	0.889	CAOH+	0.894	FECL++	0.632	ALF4-	0.889
SO4--	0.623	MGOH+	0.895	FECL2+	0.891	ALF5--	0.628
NA2SO4-	0.892	NH4+	0.002	FECL4-	0.888	ALF6---	0.351

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.731	MG++	0.14	-5.228	FE(OH)3	0.00	0.000
OH-	0.04	-5.614	NACL	0.19	-5.485	FE(OH)4-	0.00	0.000
H4SI04	86.88	-3.044	KCL	0.00	-7.315	FECL+	0.00	0.000
H3SI04-	1.42	-4.827	NA2SO4-	1.16	-5.010	FECL2	0.00	0.000
H2SI04--	0.00	-8.381	KSO4-	0.10	-6.125	FECL++	0.00	0.000
NAH3SI04-	0.19	-5.786	CASO4	0.79	-5.234	FECL2+	0.00	0.000
H3BO3	1.04	-4.774	MGO4	0.06	-6.277	FECL3	0.00	0.000
H2BO3-	0.05	-6.122	CAC03	0.13	-5.876	FECL4-	0.00	0.000
H2CO3	4.45	-4.144	MBCO3	0.00	-7.545	FESO4	0.00	0.000
HCO3-	124.63	-2.690	CAHCO3+	0.39	-5.416	FESO4+	0.00	0.000
CO3--	0.57	-5.020	MGNCO3+	0.01	-6.969	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-8.309	ALOH++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-8.713	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-19.226	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
H2SO4-	0.00	-8.802	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	65.88	-3.164	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.603	FE(OH)	0.00	0.000	ALF++	0.00	0.000
F-	13.10	-3.161	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	296.36	-2.078	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	242.56	-1.977	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	7.47	-3.719	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	6.26	-3.806	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01264

IONIC BALANCE : CATIONS (MOL.EQ.)0.01106988
ANIONS (MOL.EQ.)0.01250056
DIFFERENCE (%) -12.14

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	105.8
CHALCEDONY	75.9
NAK	99.8

1000/T DEGREES KELVIN = 3.14

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.			
ADULARIA	-19.872	99.999	ALBITE LOW	-18.883	99.999	ANALCINE	-15.021	99.999
ANHYDRITE	-4.912	-7.369	CALCITE	-8.608	-9.222	CHALCEDONY	-3.336	-3.044
MG-CHLORITE	-83.097	99.999	FLUORITE	-10.752	-10.428	GOETHITE	-8.190	99.999
LAUMONDITE	-30.502	99.999	MICROCLINE	-21.687	99.999	MAGNETITE	-32.177	99.999
CA-MONTHOR.	-101.926	99.999	K-MONTHOR.	-50.843	99.999	MG-MONTHOR.	-102.740	99.999
NA-MONTHOR.	-50.261	99.999	MUSCOVITE	-25.212	99.999	PREHNITE	-39.454	99.999
PYRRHOTITE	1.782	99.999	PYRITE	-50.886	99.999	QUARTZ	-3.701	-3.044
WAIKAKITE	-26.690	99.999	WOLLASTONITE	12.172	8.418	ZOISITE	-38.176	99.999
EPIDOTE	-146.278	99.999						

ORKUSTOFNUN JHD
1980-11-14 HORDUR

MADAGASCAR

8005090094 SOURCE DE MAHABO, TOLIARY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE		REFERENCE TEMP.	
PH/DEG.C	7.45/24.0	GAS (VOL.%)		DEGREES C	39.0 (MEASURED)
SI02	19.10	CO2			
NA	14.70	H2S		SAMPLING PRESSURE	BARS ABS.
K	13.70	H2		DISCHARGE ENTHALPY	KJ/OL/KG
CA	17.60	O2		DISCHARGE	KG/SEC.
MG	6.300	CH4			8.0
CO2	179.80	N2			
SO4	17.10			MEASURED TEMPERATURE	DEGREES C
H2S	0.00			RESISTIVITY/TEMP.	OHM/DEG.C
CL	11.10			EH/TEMP.	MV/DEG.C
F	0.27				0.00/ 0.0
DISS.SOLIDS	0.00				0.000/ 0.0

LITERS GAS PER 'KG CONDENSATE/DEG.C		MEASURED DOWNHOLE TEMP.		FLUID INFLOW	
AL	0.0000	DEGREES C/METERS		DEPTH (METERS)	
B	0.0600				
FE	0.0000				
NH3	0.0000				
H2S	<0.1				
*					
*					

IONIC STRENGTH = 0.00423

IONIC BALANCE :

CATIONS (MOL.EQ.)	0.00234265
ANIONS (MOL.EQ.)	0.00442707
DIFFERENCE (%)	-61.58

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	19.10	CO2	179.80	CO2	0.117E-01
NA	14.70	H2S	0.00	H2S	0.000E+00
K	13.70	H2	0.00	H2	0.000E+00
CA	17.60	O2	0.00	O2	0.000E+00
MG	6.299	CH4	0.00	CH4	0.000E+00
SO4	17.10	N2	0.00	N2	0.000E+00
CL	11.10	NH3	0.00	NH3	0.000E+00
F	0.27			H2O	0.698E-01
DISS.S.	0.00			TOTAL	0.814E-01
AL	0.0000				
B	0.0600				
FE	0.0000				

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.937	KSO4-	0.933	FE++	0.760	FECL+	0.931
OH-	0.930	F-	0.930	FE+++	0.557	AL+++	0.557
H3SID4-	0.931	CL-	0.929	FE0H+	0.932	AL0H+	0.757
H2SID4--	0.757	NA+	0.931	FE(OH)3-	0.932	AL(OH)2+	0.933
H2BO3-	0.929	K+	0.929	FE(OH)4--	0.756	AL(OH)4-	0.931
HCO3-	0.931	CA++	0.760	FE0H+	0.756	ALSO4+	0.931
CO3--	0.754	MG++	0.767	FE(OH)2+	0.933	AL(SO4)2-	0.931
HS-	0.930	CAHCO3+	0.933	FE(OH)4-	0.933	ALF++	0.757
S--	0.756	MGHCO3+	0.931	FES04+	0.932	ALF2+	0.933
HSD4-	0.931	CAOH+	0.933	FECL++	0.756	ALF4-	0.931
SO4--	0.752	MGOH+	0.934	FECL2+	0.932	ALF5--	0.754
NASO4-	0.933	NH4+	0.929	FECL4-	0.931	ALF6---	0.529

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.390	MG++	5.90	-3.615	FE(OH)3	0.00	0.000
OH-	0.01	-6.141	NACL	0.00	-8.164	FE(OH)4-	0.00	0.000
H4SID4	30.38	-3.500	KCL	0.00	-8.472	FECL+	0.00	0.000
H3SID4-	0.17	-5.741	NASO4-	0.02	-6.793	FECL2	0.00	0.000
H2SID4--	0.00	-9.772	KSO4-	0.05	-6.431	FECL++	0.00	0.000
NAH3SID4--	0.00	-7.870	CASO4	0.67	-5.305	FECL2+	0.00	0.000
H3BO3	0.34	-5.263	MGSO4	0.76	-5.198	FECL3	0.00	0.000
H2BO3-	0.01	-7.011	CACO3	0.29	-5.535	FECL4-	0.00	0.000
H2CO3	19.27	-3.508	MCCO3	0.09	-5.991	FES04	0.00	0.000
HCO3-	228.02	-2.427	CAHCO3+	1.88	-4.731	FES04+	0.00	0.000
CO3--	0.39	-5.192	MGHCO3+	0.77	-5.045	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-8.366	AL0H++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-7.589	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-19.247	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSD4-	0.00	-9.091	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	15.96	-3.779	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.977	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.27	-4.847	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	11.10	-3.504	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	14.70	-3.194	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	13.68	-3.456	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	16.54	-3.384	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00420

IONIC BALANCE :

CATIONS (MOL.EQ.)	0.00232768
ANIONS (MOL.EQ.)	0.00441203
DIFFERENCE (%)	-61.85

1000/T DEGREES KELVIN = 3.20

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	61.6
CHALCEDONY	31.8
NAK	401.0

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-20.246	99.999	ALBITE LOW	-19.222	99.999
ANHYDRITE	-4.848	-7.407	CALCITE	-8.550	-8.818
MG-CHLORITE	-83.628	99.999	FLUORITE	-10.000	-13.261
LAUNONDITE	-30.979	99.999	MICROCLINE	-22.117	99.999
CA-MONTHOR.	-104.146	99.999	K-MONTHOR.	-52.053	99.999
NA-MONTHOR.	-51.427	99.999	MUSCOVITE	-25.766	99.999
PYRRHOTITE	1.858	99.999	PYRITE	-51.873	99.999
WAIKAKITE	-26.998	99.999	WOLLASTONITE	12.420	7.776
EPIDOTE	-147.246	99.999			
			ANALCINE	-15.287	99.999
			CHALCEDONY	-3.398	-3.500
			GOETHITE	-8.437	99.999
			MAGNETITE	-32.648	99.999
			MG-MONTHOR.	-104.918	99.999
			PREHNITE	-39.878	99.999
			QUARTZ	-3.784	-3.500
			ZDISITE	-38.540	99.999

ORKUSTOFNUN JHD
1980-11-21 HORUR

MADAGASCAR

8005190099

RANDAFANA MAROSOVOA, TULEAR, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

PH/DEG.C	9.40/21.0
SI02	89.00
NA	69.50
K	1.04
CA	1.07
MG	0.040
CO2	93.40
SO4	16.90
H2S	0.00
CL	11.30
F	4.30
DISS. SOLIDS	0.00
AL	0.0000
B	0.0300
FE	0.0000
NH3	0.0000
H2S	<0.1
*	
*	

STEAM SAMPLE

GAS (VOL.%)	
CO2	
H2S	
H2	
O2	
CH4	
N2	

REFERENCE TEMP. DEGREES C 51.0 (MEASURED)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY KJ/OL/KG
DISCHARGE KG/SEC. 3.0

MEASURED TEMPERATURE DEGREES C 51.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

CONDENSATE (PPM)
PH/DEG.C /

CO2	0.0
H2S	0.0
NA	0.0

CONDENSATE WITH NAOH (PPM)
CO2 0.0
H2S 0.0

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0

IONIC STRENGTH = 0.00377

IONIC BALANCE : CATIONS (MOL.EQ.) 0.00308483
ANIONS (MOL.EQ.) 0.00358607
DIFFERENCE (%) -15.03

DEEP WATER (PPM)

SI02	89.01
NA	69.50
K	1.04
CA	1.07
MG	0.040
SO4	16.90
CL	11.30
F	4.30
DISS.S.	0.00
AL	0.0000
B	0.0300
FE	0.0000

CO2	93.40
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

DEEP STEAM (PPM)

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.201E-03
H2S	0.000E+00
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.129E+00
TOTAL	0.130E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

HF	0.939	KS04-	0.935	FE++	0.768	FECL+	0.933
OH-	0.933	F-	0.933	FE+++	0.569	AL+++	0.569
H3SI04-	0.933	CL-	0.932	FE0H	0.935	ALOH++	0.766
H2SI04--	0.766	NA+	0.933	FE(OH)3-	0.935	AL(OH)2+	0.935
H2BO3-	0.932	K+	0.932	FE(OH)4--	0.764	AL(OH)4-	0.934
HCO3-	0.933	CA++	0.768	FE0H++	0.764	ALSO4+	0.934
CO3--	0.762	MG++	0.775	FE(OH)2+	0.935	AL(SO4)2-	0.934
HS-	0.933	CAHCO3+	0.936	FE(OH)4-	0.935	ALF++	0.766
S--	0.764	MGHCO3+	0.933	FESO4+	0.935	ALF2+	0.935
HSO4-	0.934	CAOH+	0.936	FECL++	0.764	ALF4-	0.934
SO4--	0.760	MGOH+	0.936	FECL2+	0.935	ALF5--	0.762
NASO4-	0.935	NH4+	0.932	FECL4-	0.933	ALF6----	0.543

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

HF (ACT.)	0.00	-8.969	MG++	0.03	-5.857	FE(OH)3	0.00	0.000
OH-	0.98	-4.242	NACL	0.00	-7.323	FE(OH)4-	0.00	0.000
H4SI04	105.79	-2.958	KCL	0.00	-9.507	FECL+	0.00	0.000
H3SI04-	34.83	-3.436	NASO4-	0.11	-6.029	FECL2	0.00	0.000
H2SI04--	0.17	-5.737	KS04-	0.00	-7.449	FECL++	0.00	0.000
NAH3SI04-	1.48	-4.901	CASO4	0.04	-6.500	FECL2+	0.00	0.000
H3BO3	0.10	-5.810	MGSO4	0.01	-7.276	FECL3	0.00	0.000
H2BO3-	0.07	-5.911	CAC03	0.47	-5.332	FECL4-	0.00	0.000
H2CO3	0.26	-5.385	MGC03	0.01	-6.795	FESO4	0.00	0.000
HCO3-	119.94	-2.707	CAHCO3+	0.07	-6.150	FESO4+	0.00	0.000
CO3--	8.82	-3.833	MGHCO3+	0.00	-7.524	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-7.700	ALOH++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-7.865	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-22.043	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-10.493	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	16.77	-3.758	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-9.252	FE0H	0.00	0.000	ALF++	0.00	0.000
F-	4.30	-3.645	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	11.30	-3.497	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	69.19	-2.522	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	1.04	-4.576	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	0.84	-4.678	FE(OH)2+	0.00	0.000	ALF6----	0.00	0.000

IONIC STRENGTH = 0.00368

IONIC BALANCE : CATIONS (MOL.EQ.) 0.00308161
ANIONS (MOL.EQ.) 0.00358222
DIFFERENCE (%) -15.02

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.08

QUARTZ	115.5
CHALCEDONY	85.7
NAK	57.2

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.			
ADULARIA	-19.513	99.999	ALBITE LOW	-18.557	99.999	ANALCINE	-14.763	99.999
ANHYDRITE	-4.978	-8.670	CALCITE	-8.671	-8.743	CHALCEDONY	-3.276	-2.958
MG-CHLORITE	-82.605	99.999	FLUORITE	-10.709	-12.143	GOETHITE	-7.946	99.999
LAUKONDITE	-30.045	99.999	MICROCLINE	-21.273	99.999	MAGNETITE	-31.711	99.999
CA-MONTHOR.	-99.756	99.999	K-MONTHOR.	-49.665	99.999	MG-MONTHOR.	-100.607	99.999
NA-MONTHOR.	-49.125	99.999	MUSCOVITE	-24.676	99.999	PREHNITE	-39.054	99.999
PYRRHOTITE	1.711	99.999	PYRITE	-49.928	99.999	QUARTZ	-3.621	-2.958
WAIKAKITE	-26.396	99.999	WOLLASTONITE	11.934	10.187	ZOISITE	-37.834	99.999
EPIDOTE	-145.380	99.999						

ORKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

800000107

TABALAHELY, NOSY BE, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPH)

STEAM SAMPLE

PH/DEG.C	7.25/26.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	33.0 (MEASURED)
SI02	127.20	CO2	SAMPLING PRESSURE	BARS ABS.	
NA	1203.30	H2S	DISCHARGE ENTHALPY	MJ/OL/KG	
K	86.70	H2	DISCHARGE	KG/SEC.	0.0
CA	169.30	O2	MEASURED TEMPERATURE	DEGREES C	33.0
MG	141.000	CH4	RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
CO2	1267.70	N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0
SO4	55.60		MEASURED DOWNHOLE TEMP.	DEGREES C/METERS	
H2S	0.20		FLUID INFLOW	DEPTH (METERS)	
CL	1806.00	LITERS GAS PER 'KG			
F	0.20	CONDENSATE/DEG.C			
DISS.SOLIDS	0.00				
AL	0.0000	CONDENSATE (PPH)			
B	1.2600	PH/DEG.C			
FE	0.0000	CO2			
NH3	0.0000	H2S			
*		NA			
*					
*					
		CONDENSATE WITH NAOH (PPH)			
		CO2			
		H2S			

IONIC STRENGTH = 0.08426

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.07310809
ANIONS (MOL.EQ.) 0.07688210
DIFFERENCE (%) -5.03

DEEP WATER (PPH)

DEEP STEAM (PPH)

GAS PRESSURES (BARS ABS.)

SI02	127.21	CO2	1267.70	CO2	0.00	CO2	0.862E-01
NA	1203.30	H2S	0.20	H2S	0.00	H2S	0.213E-04
K	86.70	H2	0.00	H2	0.00	H2	0.000E+00
CA	169.30	O2	0.00	O2	0.00	O2	0.000E+00
MG	140.988	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	55.60	N2	0.00	N2	0.00	N2	0.000E+00
CL	1805.85	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	0.20					H2O	0.502E-01
DISS.S.	0.00					TOTAL	0.136E+00
AL	0.0000						
B	1.2599					H2O (%)	0.00
FE	0.0000					BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.825	KSO4-	0.791	FE++	0.414	FECL+	0.774
OH-	0.767	F-	0.767	FE+++	0.188	AL+++	0.188
H3SI04-	0.774	CL-	0.760	FE0H+	0.786	AL0H++	0.401
H2SI04--	0.401	NA+	0.774	FE(OH)3-	0.786	AL(OH)2+	0.791
H2BO3-	0.752	K+	0.760	FE(OH)4--	0.392	AL(OH)4-	0.780
HCO3-	0.774	CA++	0.414	FE0H++	0.392	ALSO4+	0.780
CO3--	0.380	MG++	0.455	FE(OH)2+	0.791	AL(SO4)2-	0.780
HS-	0.767	CANCO3+	0.798	FE(OH)4-	0.791	ALF++	0.401
S--	0.392	MGHCO3+	0.774	FES04+	0.786	ALF2+	0.791
HSO4-	0.780	CAOH+	0.798	FECL++	0.392	ALF4-	0.780
SO4--	0.367	MGOH+	0.803	FECL2+	0.786	ALF5--	0.380
NASO4-	0.791	NH4+	0.752	FECL4-	0.774	ALF6---	0.114

CHEMICAL COMPONENTS IN DEEP WATER (PPH AND LOG MOLE)

H+ (ACT.)	0.00	-7.217	MG++	120.96	-2.303	FE(OH)3	0.00	0.000
OH-	0.01	-6.405	NACL	3.06	-4.282	FE(OH)4-	0.00	0.000
H4SI04	202.43	-2.677	KCL	0.16	-5.673	FECL+	0.00	0.000
H3SI04-	0.73	-5.113	NASO4-	1.87	-4.804	FECL2	0.00	0.000
H2SI04--	0.00	-9.208	KSO4-	0.37	-5.567	FECL++	0.00	0.000
NAH3SI04-	0.39	-5.482	CASO4	3.97	-4.535	FECL2+	0.00	0.000
H3BO3	7.11	-3.939	MGSO4	10.35	-4.066	FECL3	0.00	0.000
H2BO3-	0.09	-5.808	CACO3	4.15	-4.383	FECL4-	0.00	0.000
H2CO3	164.89	-2.575	MGCO3	3.29	-4.408	FES04	0.00	0.000
HCO3-	1515.54	-1.605	CANCO3+	49.27	-3.312	FES04+	0.00	0.000
CO3--	2.59	-4.365	MGHCO3+	59.63	-3.156	AL+++	0.00	0.000
H2S	0.06	-5.757	CAOH+	0.00	-7.987	ALOH++	0.00	0.000
HS-	0.14	-5.385	MGOH+	0.01	-6.821	AL(OH)2+	0.00	0.000
S--	0.00	-14.818	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-18.956	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.799	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	42.77	-3.351	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-9.067	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.20	-4.978	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	1803.92	-1.293	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	1201.66	-1.282	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	86.51	-2.655	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	146.94	-2.436	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.08397

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.07295111
ANIONS (MOL.EQ.) 0.07672425
DIFFERENCE (%) -5.04

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.27

QUARTZ	150.9
CHALCEDONY	122.0
NAK	165.2

OXIDATION POTENTIAL (VOLTS) :
EH H2S= -0.233 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-20.637	99.999	ALBITE LOW	-19.578	99.999
ANHYDRITE	-4.787	-6.605	CALCITE	-8.496	-7.604
MG-CHLORITE	-84.200	99.999	FLUORITE	-10.855	-13.004
LAUMONDITE	-31.478	99.999	MICROCLINE	-22.567	99.999
CA-MONTHOR.	-106.436	99.999	K-MONTHOR.	-53.301	99.999
NA-MONTHOR.	-52.628	99.999	MUSCOVITE	-26.339	99.999
PYRRHOTITE	1.937	99.999	PYRITE	-52.889	99.999
WAIRAKITE	-27.321	99.999	WOLLASTONITE	12.679	8.940
EPIDOTE	-148.289	99.999			
			ANALCIME	-15.564	99.999
			CHALCEDONY	-3.462	-2.677
			GOETHITE	-8.688	99.999
			MAGNETITE	-33.127	99.999
			MG-MONTHOR.	-107.156	99.999
			PREHNITE	-40.332	99.999
			QUARTZ	-3.870	-2.677
			ZOISITE	-38.931	99.999

Appendix 6.2 Computer calculations at quartz temperature.



ORKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

7909210005

RANOMAFANA DE BETAFO, BETAFO, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

PH/DEG.C	8.21/20.0
SI02	68.50
NA	122.50
K	5.30
CA	18.50
MG	1.700
CO2	111.00
SO4	181.90
H2S	0.19
CL	7.20
F	2.57
DISS.SOLIDS	0.00
AL	0.0000
B	0.0300
FE	0.0000
NH3	0.0000
*	
*	
*	

STEAM SAMPLE

GAS (VOL.%)	
CO2	
H2S	
H2	
O2	
CH4	
N2	

LITERS GAS PER 'KG
CONDENSATE/DEG.C

CONDENSATE (PPM)	
PH/DEG.C	
CO2	
H2S	
NA	

CONDENSATE WITH NaOH (PPM)

CO2	
H2S	

IONIC STRENGTH = 0.00880

IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.00640634
 ANIONS (MOL.EQ.) 0.00653407
 DIFFERENCE (%) -1.97

SINCOR > 2.0

DEEP WATER (PPM)

SI02	68.51
NA	122.50
K	5.30
CA	18.50
MG	1.700
SO4	181.90
CL	7.20
F	2.57
DISS.S.	0.00
AL	0.0000
B	0.0300
FE	0.0000

DEEP STEAM (PPM)

CO2	111.00
H2S	0.19
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.159E-01
H2S	0.152E-04
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.177E+01
TOTAL	0.178E+01

H2O (%)
BOILING PORTION

REFERENCE TEMP. DEGREES C 0.0 (0TZ)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/OL/KG
DISCHARGE KG/SEC. 0.0

MEASURED TEMPERATURE DEGREES C 57.5
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0
0.0	0.0	0.0

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.902	KSO4-	0.893	FE++	0.642	FECL+	0.889
OH-	0.887	F-	0.887	FE+++	0.397	AL+++	0.397
H3SI04-	0.889	CL-	0.886	FEOH+	0.892	ALOH++	0.637
H2SI04--	0.637	NA+	0.889	FE(OH)3-	0.892	AL(OH)2+	0.893
H2BO3-	0.884	K+	0.886	FE(OH)4--	0.634	AL(OH)4-	0.890
HCO3-	0.889	CA++	0.642	FEOH++	0.634	ALSO4+	0.890
CO3--	0.630	MG++	0.656	FE(OH)2+	0.893	AL(SO4)2-	0.890
HS-	0.887	CAHCO3+	0.894	FE(OH)4-	0.893	ALF++	0.637
S--	0.634	MGHCO3+	0.889	FESO4+	0.892	ALF2+	0.893
H2SO4-	0.890	CAOH+	0.894	FECL++	0.634	ALF4-	0.890
SO4--	0.626	MGOH+	0.896	FECL2+	0.892	ALF5--	0.630
NASO4-	0.893	NH4+	0.884	FECL4-	0.889	ALF6---	0.354

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.649	MG++	0.77	-4.502	FE(OH)3	0.00	0.000
OH-	0.81	-4.321	NACL	0.01	-6.597	FE(OH)4-	0.00	0.000
H4SI04	102.36	-2.973	KCL	0.00	-8.633	FECL+	0.00	0.000
H3SI04-	6.78	-4.147	NASO4-	3.60	-4.519	FECL2	0.00	0.000
H2SI04--	0.00	-7.298	KSO4-	0.48	-5.446	FECL++	0.00	0.000
NAH3SI04-	0.45	-5.422	CASO4	12.12	-4.050	FECL2+	0.00	0.000
H3BO3	0.16	-5.582	MESO4	4.37	-4.440	FECL3	0.00	0.000
H2BO3-	0.01	-6.800	CACO3	1.87	-4.728	FECL4-	0.00	0.000
H2CO3	8.60	-3.858	MGCO3	0.04	-6.303	FESO4	0.00	0.000
HCO3-	140.35	-2.638	CAHCO3+	5.40	-4.272	FESO4+	0.00	0.000
CO3--	0.58	-5.014	MGNCO3+	0.10	-5.931	AL+++	0.00	0.000
H2S	0.01	-6.404	CAOH+	0.02	-6.372	ALOH++	0.00	0.000
HS-	0.17	-5.286	MGOH+	0.02	-6.331	AL(OH)2+	0.00	0.000
S--	0.00	-13.404	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-16.785	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
H2SO4-	0.00	-7.341	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	166.60	-2.761	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.573	FEOH+	0.00	0.000	ALF++	0.00	0.000
F-	2.57	-3.869	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	7.19	-3.693	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	121.71	-2.276	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	5.16	-3.880	FE(OH)4+	0.00	0.000	ALF5--	0.00	0.000
CA++	12.02	-3.523	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00827 IONIC BALANCE :
CATIONS (MOL.EQ.) 0.00614451
ANIONS (MOL.EQ.) 0.00625064
DIFFERENCE (%) -1.71

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	113.8
CHALCEDONY	84.0
NAK	122.5

1000/T DEGREES KELVIN = 2.57

OXIDATION POTENTIAL (VOLTS) :
EH H2S= -0.414 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

ADULARIA	TEOR. -16.272	CALC. 99.999	ALBITE LOW	TEOR. -15.587	CALC. 99.999	ANALCIME	TEOR. -12.380	CALC. 99.999
AMHYDRITE	TEOR. -5.844	CALC. -6.680	CALCITE	TEOR. -9.597	CALC. -8.930	CHALCEDONY	TEOR. -2.737	CALC. -2.973
MG-CHLORITE	TEOR. -79.244	CALC. 99.999	FLUORITE	TEOR. -10.535	CALC. -11.557	GOETHITE	TEOR. -5.303	CALC. 99.999
LAUMONDITE	TEOR. -25.798	CALC. 99.999	MICROCLINE	TEOR. -17.553	CALC. 99.999	MAGNETITE	TEOR. -26.776	CALC. 99.999
CA-MONTHOR.	TEOR. -77.752	CALC. 99.999	K-MONTHOR.	TEOR. -37.895	CALC. 99.999	MG-MONTHOR.	TEOR. -78.691	CALC. 99.999
NA-MONTHOR.	TEOR. -37.701	CALC. 99.999	MUSCOVITE	TEOR. -19.434	CALC. 99.999	PREHNITE	TEOR. -35.695	CALC. 99.999
PYRRHOTITE	TEOR. 1.148	CALC. 99.999	PYRITE	TEOR. -41.193	CALC. 99.999	QUARTZ	TEOR. -2.930	CALC. -2.973
WAIKITE	TEOR. -23.655	CALC. 99.999	WOLLASTONITE	TEOR. 9.826	CALC. 8.609	ZOISITE	TEOR. -34.787	CALC. 99.999
EPIDOTE	TEOR. -139.416	CALC. 99.999						

ORKUSTOFNUN JHD
1980-11-14 HORDUR

MADAGASCAR

7909210006

ANDRONTSARA-ANTSIRA, ENVIRONS DE ANTRIRABE, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPH)

STEAM SAMPLE

PH/DEG.C	5.95/21.0
SI02	91.00
NA	7.00
K	11.30
CA	26.90
MG	17.500
CO2	459.00
SO4	2.00
H2S	0.10
CL	1.50
F	0.10
DISS.SOLIDS	0.00
AL	0.0000
B	0.0000
FE	0.0000
NH3	0.0000
B	<0.01
SO4	<2.0
F	*0.1

GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
CO2	SAMPLING PRESSURE	BARS ABS.	
H2S	DISCHARGE ENTHALPY	KJ/OL/KG	
H2	DISCHARGE	KG/SEC.	0.0
O2	MEASURED TEMPERATURE	DEGREES C	18.0
CH4	RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C

MEASURED DOWNHOLE TEMP.
DEGREES C/METERS

CONDENSATE (PPH)
PH/DEG.C

CONDENSATE WITH NaOH (PPH)

IONIC STRENGTH = 0.00450

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.00334085
ANIONS (MOL.EQ.) 0.00291273
DIFFERENCE (%) 13.69

DEEP WATER (PPH)

SI02	91.01
NA	7.00
K	11.30
CA	26.90
MG	17.499
SO4	2.00
CL	1.50
F	0.10
DISS.S.	0.00
AL	0.0000
B	0.0000
FE	0.0000

CO2	459.00
H2S	0.10
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

DEEP STEAM (PPH)

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.950E+00
H2S	0.921E-04
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
H2O	0.288E+01
TOTAL	0.383E+01

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.922	KSO4-	0.916	FE++	0.709	FECL+	0.914
OH-	0.913	F-	0.913	FE+++	0.482	AL+++	0.482
H3SI04-	0.914	CL-	0.912	FE0H+	0.916	AL0H++	0.706
H2SI04--	0.706	NA+	0.914	FE(OH)3-	0.916	AL(OH)2+	0.916
H2BO3-	0.911	K+	0.912	FE(OH)4--	0.704	AL(OH)4-	0.915
HCO3-	0.914	CA++	0.709	FE0H++	0.704	ALSO4+	0.915
CO3--	0.702	MG++	0.718	FE(OH)2+	0.916	AL(SO4)2-	0.915
HS-	0.913	CANCO3+	0.917	FE(OH)4-	0.916	ALF++	0.706
S--	0.704	MGHCO3+	0.914	FES04+	0.916	ALF2+	0.916
HSO4-	0.915	CAOH+	0.917	FECL++	0.704	ALF4-	0.915
SO4--	0.699	MGOH+	0.918	FECL2+	0.916	ALF5--	0.702
NASO4-	0.916	NH4+	0.911	FECL4-	0.914	ALF6---	0.451

CHEMICAL COMPONENTS IN DEEP WATER (PPH AND LOG MOLE)

H+ (ACT.)	0.00	-6.075	MG++	16.38	-3.171	FE(OH)3	0.00	0.000
OH-	0.03	-5.710	NACL	0.00	-8.394	FE(OH)4-	0.00	0.000
H4SI04	145.28	-2.821	KCL	0.00	-8.845	FECL+	0.00	0.000
H3SI04-	0.29	-5.518	NASO4-	0.00	-7.822	FECL2	0.00	0.000
H2SI04--	0.00	-10.259	KSO4-	0.01	-7.158	FECL++	0.00	0.000
NAH3SI04-	0.00	-8.002	CASO4	0.21	-5.805	FECL2+	0.00	0.000
H3BO3	0.00	0.000	MGSO4	0.98	-5.088	FECL3	0.00	0.000
H2BO3-	0.00	0.000	CACO3	0.16	-5.809	FECL4-	0.00	0.000
H2CO3	470.14	-2.120	MGCO3	0.04	-6.360	FES04	0.00	0.000
HCO3-	161.47	-2.577	CANCO3+	16.68	-3.783	FES04+	0.00	0.000
CO3--	0.01	-6.623	MGHCO3+	3.14	-4.434	AL+++	0.00	0.000
H2S	0.08	-5.655	CAOH+	0.00	-7.402	AL0H++	0.00	0.000
HS-	0.02	-6.143	MGOH+	0.02	-6.253	AL(OH)2+	0.00	0.000
S--	0.00	-15.721	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-15.401	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-7.699	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	1.05	-4.959	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.245	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.10	-5.283	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	1.50	-4.374	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	7.00	-3.516	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	11.30	-3.539	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	20.16	-3.298	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00412

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.00314947
ANIONS (MOL.EQ.) 0.00272180
DIFFERENCE (%) 14.57

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.47

QUARTZ	132.0
CHALCEDONY	102.5
NAK	401.0

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.314 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

ADULARIA	TEOR. -15.619	CALC. 99.999	ALBITE LOW	TEOR. -14.980	CALC. 99.999	ANALCINE	TEOR. -11.894	CALC. 99.999
ANHYDRITE	TEOR. -6.084	CALC. -8.563	CALCITE	TEOR. -9.882	CALC. -10.225	CHALCEDONY	TEOR. -2.633	CALC. -2.821
MG-CHLORITE	TEOR. -78.864	CALC. 99.999	FLUORITE	TEOR. -10.550	CALC. -14.093	GOETHITE	TEOR. -4.633	CALC. 99.999
LAUNDMONDITE	TEOR. -24.913	CALC. 99.999	MICROCLINE	TEOR. -16.812	CALC. 99.999	MAGNETITE	TEOR. -25.566	CALC. 99.999
CA-MONTHOR.	TEOR. -72.742	CALC. 99.999	K-MONTHOR.	TEOR. -35.257	CALC. 99.999	MG-MONTHOR.	TEOR. -73.641	CALC. 99.999
NA-MONTHOR.	TEOR. -35.121	CALC. 99.999	MUSCOVITE	TEOR. -18.280	CALC. 99.999	PREHNITE	TEOR. -35.066	CALC. 99.999
PYRRHOTITE	TEOR. 1.060	CALC. 99.999	PYRITE	TEOR. -39.480	CALC. 99.999	QUARTZ	TEOR. -2.805	CALC. -2.821
WAIKAKITE	TEOR. -23.076	CALC. 99.999	WOLLASTONITE	TEOR. 9.421	CALC. 5.882	ZOISITE	TEOR. -34.154	CALC. 99.999
EPIDOTE	TEOR. -138.842	CALC. 99.999						

ORKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

7909270011

SOURCE D'AMBARAKY, AMALAVORY-ITASY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	6.54/23.0
SI02	73.70
NA	224.50
K	27.90
CA	277.90
MG	159.700
CO2	1732.00
SO4	104.20
H2S	0.10
CL	151.00
F	0.44
DISS.SOLIDS	0.00
AL	0.0000
B	0.2400
FE	0.0000
NH3	0.0000

GAS (VOL.%)	
CO2	
H2S	
H2	
O2	
CH4	
N2	

REFERENCE TEMP. DEGREES C 0.0 (RTZ)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/OL/KG
DISCHARGE KG/SEC. 0.0

MEASURED TEMPERATURE DEGREES C 24.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

CONDENSATE (PPM)	
PH/DEG.C /	
CO2	0.0
H2S	0.0
NA	0.0

CONDENSATE WITH NAOH (PPM)

CO2	0.0
H2S	0.0

IONIC STRENGTH = 0.04496

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.03534692
ANIONS (MOL.EQ.) 0.02961237
DIFFERENCE (%) 17.66

DEEP WATER (PPM)

SI02	73.71
NA	224.50
K	27.90
CA	277.90
MG	159.687
SO4	104.20
CL	150.99
F	0.44
DISS.S.	0.00
AL	0.0000
B	0.2400
FE	0.0000

CO2	1732.00
H2S	0.10
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

DEEP STEAM (PPM)

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.166E+01
H2S	0.527E-04
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.205E+01
TOTAL	0.371E+01

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.836	KS04-	0.811	FE++	0.448	FECL+	0.799
OH-	0.794	F-	0.794	FE+++	0.206	AL+++	0.206
H3SI04-	0.799	CL-	0.789	FE0H+	0.808	AL0H+	0.437
H2SI04--	0.437	NA+	0.799	FE(OH)3-	0.808	AL(OH)2+	0.811
H2B03-	0.784	K+	0.789	FE(OH)4--	0.430	AL(OH)4--	0.803
HCO3-	0.799	CA++	0.448	FE0H++	0.430	ALSO4+	0.803
CO3--	0.421	MG++	0.480	FE(OH)2+	0.811	AL(SO4)2-	0.803
HS-	0.794	CAHCO3+	0.816	FE(OH)4-	0.811	ALF++	0.437
S--	0.430	MGHCO3+	0.799	FES04+	0.808	ALF2+	0.811
HSO4-	0.803	CAOH+	0.816	FECL++	0.430	ALF4-	0.803
SO4--	0.412	MGOH+	0.819	FECL2+	0.808	ALF5--	0.421
NAS04-	0.811	NH4+	0.784	FECL4-	0.799	ALF6---	0.144

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-6.559	MG++	115.13	-2.325	FE(OH)3	0.00	0.000
OH-	0.08	-5.302	NACL	0.49	-5.075	FE(OH)4-	0.00	0.000
H4SI04	117.10	-2.914	KCL	0.02	-6.652	FECL+	0.00	0.000
H3SI04-	0.74	-5.111	NAS04-	0.97	-5.089	FECL2	0.00	0.000
H2SI04--	0.00	-9.227	KS04-	0.38	-5.551	FECL++	0.00	0.000
NAH3SI04-	0.07	-6.212	CAS04	13.13	-4.016	FECL2+	0.00	0.000
H3B03	1.36	-4.656	MGS04	73.36	-3.215	FECL3	0.00	0.000
H2B03-	0.01	-6.908	CAC03	9.50	-4.023	FECL4-	0.00	0.000
H2CO3	881.50	-1.847	MGC03	3.11	-4.433	FES04	0.00	0.000
HCO3-	1229.65	-1.696	CAHCO3+	371.08	-2.435	FES04+	0.00	0.000
CO3--	0.54	-5.048	MGHCO3+	100.76	-2.928	AL+++	0.00	0.000
H2S	0.05	-5.872	CAOH+	0.02	-6.482	AL0H++	0.00	0.000
HS-	0.05	-5.799	MGOH+	0.23	-5.253	AL(OH)2+	0.00	0.000
S--	0.00	-14.843	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-15.347	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.01	-6.995	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	35.33	-3.434	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.254	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.44	-4.636	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	150.68	-2.372	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	224.11	-2.011	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	27.78	-3.148	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	123.10	-2.513	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.03625

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.03093061
ANIONS (MOL.EQ.) 0.02519314
DIFFERENCE (%) 20.45

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.54

QUARTZ	120.6
CHALCEDONY	90.9
NAK	222.0

OXIDATION POTENTIAL (VOLTS) :
EH H2S= -0.329
EH CH4= 99.999
EH H2= 99.999
EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-16.077	99.999	ALBITE LOW	-15.407	99.999	ANALCINE	-12.235	99.999
ANHYDRITE	-5.913	-6.682	CALCITE	-9.678	-8.286	CHALCEDONY	-2.706	-2.914
MG-CHLORITE	-79.119	99.999	FLUORITE	-10.538	-12.335	GOETHITE	-5.110	99.999
LAUMONDITE	-25.536	99.999	MICROCLINE	-17.332	99.999	MAGNETITE	-26.426	99.999
CA-MONTHOR.	-76.279	99.999	K-MONTHOR.	-37.118	99.999	MG-MONTHOR.	-77.209	99.999
NA-MONTHOR.	-36.943	99.999	MUSCOVITE	-19.094	99.999	PREHNITE	-35.506	99.999
PYRRHOTITE	1.121	99.999	PYRITE	-40.681	99.999	QUARTZ	-2.892	-2.914
MAIRAKITE	-23.483	99.999	MOLLASTONITE	9.704	7.342	ZOISITE	-34.599	99.999
EPIDOTE	-139.219	99.999						

ORKUSTOFNUN JHD
1980-11-14 HQRDUR

MADAGASCAR

7909270012

SOURCE DES MOCAIS D'IFANJA, MIARINARIVO-ITASY, MADAGASCAR.

PROGRAM MATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	6.98/23.0
SI02	107.00
NA	351.50
K	22.50
CA	208.50
MG	202.200
CO2	1152.00
SO4	940.10
H2S	0.15
CL	77.50
F	1.77
DISS.SOLIDS	0.00
AL	0.0000
B	0.0600
FE	0.0000
NH3	0.0000
*	
*	
*	

GAS (VOL.%)	
CO2	
H2S	
H2	
O2	
CH4	
N2	

REFERENCE TEMP. DEGREES C 0.0 (QTZ)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY HJ/OL/KG
DISCHARGE KG/SEC. 0.0

MEASURED TEMPERATURE DEGREES C 46.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

CONDENSATE (PPM)	
PH/DEG.C	
CO2	
H2S	
NA	

CONDENSATE WITH NAOH (PPM)
CO2
H2S

IONIC STRENGTH = 0.05489

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.03703453
ANIONS (MOL.EQ.) 0.03775740
DIFFERENCE (%) -1.93

DEEP WATER (PPM)

SI02	107.01
NA	351.50
K	22.50
CA	208.50
MG	202.183
SO4	940.08
CL	77.49
F	1.77
DISS.S.	0.00
AL	0.0000
B	0.0600
FE	0.0000

CO2	1152.00
H2S	0.15
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

DEEP STEAM (PPM)

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.629E+00
H2S	0.399E-04
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.373E+01
TOTAL	0.435E+01

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.827	KS04-	0.801	FE++	0.427	FECL+	0.788
OH-	0.783	F-	0.783	FE+++	0.188	AL+++	0.188
H3SI04-	0.788	CL-	0.778	FE0H+	0.797	ALOH++	0.416
H2SI04--	0.416	NA+	0.788	FE(OH)3-	0.797	AL(OH)2+	0.801
H2B03-	0.772	K+	0.778	FE(OH)4--	0.409	AL(OH)4-	0.793
HCO3-	0.788	CA++	0.427	FE0H++	0.409	ALSO4+	0.793
CO3--	0.400	MG++	0.459	FE(OH)2+	0.801	AL(SO4)2-	0.793
HS-	0.783	CAHCO3+	0.806	FE(OH)4-	0.801	ALF++	0.416
S--	0.409	MGHCO3+	0.788	FES04+	0.797	ALF2+	0.801
HSD4-	0.793	CAOH+	0.806	FECL+	0.409	ALF4-	0.793
SD4--	0.390	MGOH+	0.810	FECL2+	0.797	ALF5--	0.400
NAS04-	0.801	NH4+	0.772	FECL4-	0.788	ALF6---	0.128

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.102	MG++	64.37	-2.577	FE(OH)3	0.00	0.000
OH-	0.52	-4.517	NACL	0.49	-5.074	FE(OH)4-	0.00	0.000
H4SI04	166.29	-2.762	KCL	0.01	-6.936	FECL+	0.00	0.000
H3SI04-	4.30	-4.345	NAS04-	19.86	-3.778	FECL2	0.00	0.000
H2SI04--	0.00	-7.895	KS04-	3.97	-4.532	FECL++	0.00	0.000
NAH3SI04-	0.65	-5.256	CAS04	99.71	-3.135	FECL2+	0.00	0.000
H3B03	0.34	-5.264	MGS04	588.44	-2.311	FECL3	0.00	0.000
H2B03-	0.01	-6.962	CAC03	22.65	-3.645	FECL4-	0.00	0.000
H2CO3	293.61	-2.325	MGC03	6.23	-4.132	FES04	0.00	0.000
HCO3-	1087.85	-1.749	CAHCO3+	263.77	-2.584	FES04+	0.00	0.000
CO3--	1.40	-4.632	MGHCO3+	58.21	-3.166	AL+++	0.00	0.000
H2S	0.03	-6.041	CAOH+	0.08	-5.877	ALOH++	0.00	0.000
HS-	0.12	-5.457	MGOH+	1.01	-4.613	AL(OH)2+	0.00	0.000
S--	0.00	-13.759	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-14.934	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSD4-	0.06	-6.228	FE++	0.00	0.000	ALSO4+	0.00	0.000
SD4--	381.22	-2.401	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-6.997	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	1.77	-4.031	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	77.19	-2.662	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	347.34	-1.821	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	21.35	-3.263	FE(OH)4-	0.00	0.000	ALF5--	0.00	0.000
CA++	65.45	-2.787	FE(OH)++	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.03612

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.02753335
ANIONS (MOL.EQ.) 0.02816136
DIFFERENCE (%) -2.26

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.41

QUARTZ	139.5
CHALCEDONY	110.2
NAK	151.6

OXIDATION POTENTIAL (VOLTS) :
EH H2S= -0.405
EH CH4= 99.999
EH H2= 99.999
EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-15.269	99.999	ALBITE LOW	-14.653	99.999
ANHYDRITE	-6.224	-5.967	CALCITE	-10.054	-8.187
MG-CHLORITE	-78.706	99.999	FLUORITE	-10.564	-11.432
LAUMONDITE	-24.434	99.999	MICROCLINE	-16.414	99.999
CA-MONTHOR.	-69.973	99.999	K-MONTHOR.	-33.800	99.999
NA-MONTHOR.	-33.695	99.999	MUSCOVITE	-17.645	99.999
PYRRHOTITE	1.016	99.999	PYRITE	-38.565	99.999
MAIRAKITE	-22.762	99.999	WOLLASTONITE	9.206	8.286
EPIDOTE	-138.643	99.999			
			ANALCIME	-11.633	99.999
			CHALCEDONY	-2.578	-2.762
			GOETHITE	-4.244	99.999
			MAGNETITE	-24.871	99.999
			MG-MONTHOR.	-70.842	99.999
			PREHNITE	-34.736	99.999
			QUARTZ	-2.738	-2.762
			ZOISITE	-33.812	99.999

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

7909300014

ANDRANOMAFANA DE BETSIAKA, AMBILobe, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPH)

PH/DEG.C	7.45/32.0
SI02	106.10
NA	396.20
K	21.00
CA	48.30
MG	4.700
CO2	293.00
SO4	422.80
H2S	0.14
CL	185.00
F	3.95
DISS.SOLIDS	0.00
AL	0.0000
B	0.2200
FE	0.0000
NH3	0.0000

STEAM SAMPLE

GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
CO2	SAMPLING PRESSURE	BARS ABS.	
H2S	DISCHARGE ENTHALPY	MJ/OL/KG	
H2	DISCHARGE	KG/SEC.	0.0
O2	MEASURED TEMPERATURE	DEGREES C	78.0
CH4	RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C

CONDENSATE (PPH)	0.0	0.0	0.0
PH/DEG.C	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
NA	0.0	0.0	0.0

CONDENSATE WITH NaOH (PPH)

CONDENSATE WITH NaOH (PPH)	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.02527

IONIC BALANCE : CATIONS (MOL.EQ.) 0.02004252
 ANIONS (MOL.EQ.) 0.01989058
 DIFFERENCE (%) 0.76

SIHCOR > 2.0

DEEP WATER (PPH)

SI02	106.11
NA	396.20
K	21.00
CA	48.30
MG	4.700
SO4	422.79
CL	184.98
F	3.95
DISS.S.	0.00
AL	0.0000
B	0.2200
FE	0.0000

DEEP STEAM (PPH)

CO2	293.00
H2S	0.14
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.860E-01
H2S	0.184E-04
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.365E+01
TOTAL	0.373E+01

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.850	KSO4-	0.830	FE++	0.487	FECL+	0.821
OH-	0.817	F-	0.817	FE+++	0.236	AL+++	0.236
H3SI04-	0.821	CL-	0.813	FE0H+	0.827	ALOH++	0.478
H2SI04--	0.478	NA+	0.821	FE(OH)3-	0.827	AL(OH)2+	0.830
H2BO3-	0.809	K+	0.813	FE(OH)4-	0.472	AL(OH)4-	0.824
HCO3-	0.821	CA++	0.487	FE0H++	0.472	ALSO4+	0.824
CO3--	0.465	MG++	0.514	FE(OH)2+	0.830	AL(SO4)2-	0.824
HS-	0.817	CAHCO3+	0.834	FE(OH)4-	0.830	ALF++	0.478
S--	0.472	MGHCO3+	0.821	FES04+	0.827	ALF2+	0.830
HSO4-	0.824	CAOH+	0.834	FECL++	0.472	ALF4-	0.824
SO4--	0.457	MGOH+	0.837	FECL2+	0.827	ALF5--	0.465
NASO4-	0.830	NH4+	0.809	FECL4-	0.821	ALF6---	0.179

CHEMICAL COMPONENTS IN DEEP WATER (PPH AND LOG MOLE)

H+ (ACT.)	0.00	-7.472	MG++	1.39	-4.243	FE(OH)3	0.00	0.000
OH-	1.14	-4.174	NACL	1.43	-4.612	FE(OH)4-	0.00	0.000
H4SI04	159.04	-2.781	KCL	0.02	-6.557	FECL+	0.00	0.000
H3SI04-	9.20	-4.014	NASO4-	24.52	-3.686	FECL2	0.00	0.000
H2SI04--	0.01	-7.238	KSO4-	4.05	-4.523	FECL++	0.00	0.000
NAH3SI04-	1.71	-4.840	CASO4	40.65	-3.525	FECL2+	0.00	0.000
H3BO3	1.20	-4.710	MGSO4	15.45	-3.891	FECL3	0.00	0.000
H2BO3-	0.05	-6.060	CACD3	6.41	-4.193	FECL4-	0.00	0.000
H2CO3	40.66	-3.183	MGCCO3	0.11	-5.867	FES04	0.00	0.000
HCO3-	342.40	-2.251	CAHCO3+	30.81	-3.516	FES04+	0.00	0.000
CO3--	0.93	-4.809	MGHCO3+	0.44	-5.289	AL+++	0.00	0.000
H2S	0.01	-6.370	CAOH+	0.06	-5.961	ALOH++	0.00	0.000
HS-	0.12	-5.434	MGOH+	0.05	-5.888	AL(OH)2+	0.00	0.000
S--	0.00	-13.418	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-15.648	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.03	-6.582	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	359.09	-2.427	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.006	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	3.95	-3.682	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	184.11	-2.285	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	390.57	-1.770	FE(OH)4-	0.00	0.000	ALF4-	0.00	0.000
K+	19.82	-3.295	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	21.51	-3.270	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.02319

IONIC BALANCE : CATIONS (MOL.EQ.) 0.01899533
 ANIONS (MOL.EQ.) 0.01868825
 DIFFERENCE (%) 1.63

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	137.0
CHALCEDONY	107.6
NAK	136.0

1000/T DEGREES KELVIN = 2.42

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.438 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEGR.	CALC.		TEGR.	CALC.
ADULARIA	-15.298	99.999	ALBITE LOW	-14.680	99.999
ANHYDRITE	-6.212	-6.351	CALCITE	-10.039	-8.725
MG-CHLORITE	-78.718	99.999	FLUORITE	-10.563	-11.123
LAUMONDITE	-24.473	99.999	MICROCLINE	-16.446	99.999
CA-MONTMOR.	-70.199	99.999	K-MONTMOR.	-33.919	99.999
NA-MONTMOR.	-33.812	99.999	MUSCOVITE	-17.697	99.999
PYRRHOTITE	1.020	99.999	PYRITE	-38.640	99.999
WAIKIKITE	-22.788	99.999	WOLLASTONITE	9.223	8.579
EPIDOTE	-138.656	99.999			
			ANALCIME	-11.654	99.999
			CHALCEDONY	-2.582	-2.781
			GOETHITE	-4.276	99.999
			MAGNETITE	-24.929	99.999
			MG-MONTMOR.	-71.072	99.999
			PREHNITE	-34.763	99.999
			QUARTZ	-2.744	-2.781
			ZDISITE	-33.839	99.999

DRKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

7910290018

SOURCE ANDRANOMAFANA DE MAEVADOANY, ANTRIRAMANA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	7.38/20.0
SI02	84.10
NA	244.40
K	13.10
CA	38.30
MG	8.300
CO2	351.00
SO4	175.00
H2S	0.00
CL	56.20
F	4.01
DISS.SOLIDS	0.00
AL	0.0000
B	0.0800
FE	0.0000
NH3	0.0000
H2S	<0.1
*	
*	

GAS (VOL.%)
CO2
H2S
H2
O2
CH4
N2

REFERENCE TEMP. DEGREES C 0.0 (BTZ)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/OL/KG
DISCHARGE KG/SEC. 0.5

MEASURED TEMPERATURE DEGREES C 46.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

CONDENSATE (PPM)	0.0	0.0	0.0
PH/DEG.C	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
H2	0.0	0.0	0.0
NA	0.0	0.0	0.0

CONDENSATE WITH NaOH (PPM)

CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.01576

IONIC BALANCE : CATIONS (MOL.EQ.)0.01330329
ANIONS (MOL.EQ.)0.01247005
DIFFERENCE (%) 6.47

SINCOR > 2.0

DEEP WATER (PPM)

SI02	84.11
NA	244.40
K	13.10
CA	38.30
MG	8.299
SO4	175.00
CL	56.20
F	4.01
DISS.S.	0.00
AL	0.0000
B	0.0800
FE	0.0000

DEEP STEAM (PPM)

CO2	351.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.104E+00
H2S	0.000E+00
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.252E+01
TOTAL	0.263E+01

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.877	KS04-	0.863	FE++	0.564	FECL+	0.857
OH-	0.854	F-	0.854	FE+++	0.310	AL+++	0.310
H3SI04-	0.857	CL-	0.852	FE0H+	0.861	AL0H+	0.557
H2SI04--	0.557	NA+	0.857	FE(OH)3-	0.861	AL(OH)2+	0.863
H2B03-	0.849	K+	0.852	FE(OH)4--	0.553	AL(OH)4-	0.859
HCO3-	0.857	CA++	0.564	FE0H++	0.553	ALSO4+	0.859
CO3--	0.547	MG++	0.584	FE(OH)2+	0.863	AL(SO4)2-	0.859
HS-	0.854	CAHCO3+	0.865	FE(OH)4-	0.863	ALF++	0.557
S--	0.553	MGHCO3+	0.857	FES04+	0.861	ALF2+	0.863
HSO4-	0.859	CAOH+	0.865	FECL++	0.553	ALF4-	0.859
SO4--	0.541	MGOH+	0.867	FECL2+	0.861	ALF5---	0.547
NAS04-	0.863	NH4+	0.849	FECL4-	0.857	ALF6---	0.258

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.381	MG++	3.96	-3.788	FE(OH)3	0.00	0.000
OH-	0.64	-4.427	NACL	0.25	-5.364	FE(OH)4-	0.00	0.000
H4SI04	128.61	-2.874	KCL	0.00	-7.307	FECL+	0.00	0.000
H3SI04-	5.33	-4.251	NAS04-	6.15	-4.287	FECL2	0.00	0.000
H2SI04--	0.00	-7.613	KS04-	1.04	-5.114	FECL++	0.00	0.000
NAH3SI04-	0.66	-5.253	CAS04	15.98	-3.930	FECL2+	0.00	0.000
H3B03	0.44	-5.146	MGS04	18.65	-3.810	FECL3	0.00	0.000
H2B03-	0.02	-6.607	CAC03	5.31	-4.275	FECL4-	0.00	0.000
H2CO3	52.16	-3.075	MCC03	0.33	-5.401	FES04	0.00	0.000
HCO3-	411.95	-2.171	CAHCO3+	29.65	-3.533	FES04+	0.00	0.000
CO3--	0.93	-4.811	MGHCO3+	1.51	-4.752	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH	0.03	-6.258	AL0H+	0.00	0.000
HS-	0.00	0.000	MGOH	0.08	-5.708	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-16.100	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.01	-7.022	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	143.12	-2.827	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
F	0.00	-7.017	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	4.01	-3.676	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	56.04	-2.801	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	242.98	-1.976	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	12.80	-3.485	FE(OH)++	0.00	0.000	ALF5---	0.00	0.000
CA++	19.69	-3.309	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01424

IONIC BALANCE : CATIONS (MOL.EQ.)0.01251811
ANIONS (MOL.EQ.)0.01164739
DIFFERENCE (%) 7.21

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.49

QUARTZ	125.5
CHALCEDONY	95.9
NAK	139.3

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

ADULARIA	TEOR. -15.797	CALC. 99.999	ALBITE LOW	TEOR. -15.146	CALC. 99.999	ANALCINE	TEOR. -12.026	CALC. 99.999
ANHYDRITE	TEOR. -6.016	CALC. 99.999	CALCITE	TEOR. -9.801	CALC. 99.999	CHALCEDONY	TEOR. -2.661	CALC. 99.999
MG-CHLORITE	TEOR. -78.956	CALC. 99.999	FLUORITE	TEOR. -10.544	CALC. 99.999	GOETHITE	TEOR. -4.822	CALC. 99.999
LAUNONDITE	TEOR. -25.155	CALC. 99.999	MICROCLINE	TEOR. -17.013	CALC. 99.999	MAGNETITE	TEOR. -25.905	CALC. 99.999
CA-MONTHOR.	TEOR. -74.127	CALC. 99.999	K-MONTHOR.	TEOR. -35.984	CALC. 99.999	MG-MONTHOR.	TEOR. -75.037	CALC. 99.999
NA-MONTHOR.	TEOR. -35.833	CALC. 99.999	MUSCOVITE	TEOR. -18.598	CALC. 99.999	PREHNITE	TEOR. -35.236	CALC. 99.999
PYRRHOTITE	TEOR. 1.083	CALC. 99.999	PYRITE	TEOR. -39.944	CALC. 99.999	QUARTZ	TEOR. -2.838	CALC. 99.999
WAIKITE	TEOR. -23.234	CALC. 99.999	MOLLASTONITE	TEOR. 9.531	CALC. 8.332	ZOISITE	TEOR. -34.327	CALC. 99.999
EPIDOTE	TEOR. -138.973	CALC. 99.999						

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

7911050022

SOURCE DE SAKARAMY, ANTSIRANANA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	6.82/28.0	GAS (VOL.Z)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
SI02	98.60	CO2	SAMPLING PRESSURE	BARS ABS.	
NA	140.70	H2S	DISCHARGE ENTHALPY	KJ/DOUL/KG	
K	24.20	H2	DISCHARGE	KG/SEC.	0.1
CA	101.50	O2	MEASURED TEMPERATURE	DEGREES C	27.0
MG	71.700	CH4	RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
CO2	408.10	N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0
SO4	3.30				
H2S	0.00				
CL	30.50				
F	0.19				
DISS.SOLIDS	0.00	LITERS GAS PER 'KG	MEASURED DOWNHOLE TEMP.	DEGREES C/METERS	FLUID INFLOW
AL	0.0000	CONDENSATE/DEG.C			DEPTH (METERS)
B	0.8800				
FE	0.0000	CONDENSATE (PPM)			
NH3	0.0000	PH/DEG.C			
H2S	<0.1	CO2			
*		H2S			
*		NA			
		CONDENSATE WITH NAOH (PPM)			
		CO2			
		H2S			

IONIC STRENGTH = 0.01784

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01741363
ANIONS (MOL.EQ.) 0.00778032
DIFFERENCE (%) 76.47

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	98.61	CO2	408.10	CO2	0.00	CO2	0.292E+00
NA	140.70	H2S	0.00	H2S	0.00	H2S	0.000E+00
K	24.20	H2	0.00	H2	0.00	H2	0.000E+00
CA	101.50	O2	0.00	O2	0.00	O2	0.000E+00
MG	71.694	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	3.30	N2	0.00	N2	0.00	N2	0.000E+00
CL	30.50	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	0.19			H2O		H2O	0.327E+01
DISS.S.	0.00			TOTAL		TOTAL	0.356E+01
AL	0.0000						
B	0.8799			H2O (%)	0.00		
FE	0.0000			BOILING PORTION	0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.870	KSO4-	0.854	FE++	0.542	FECL+	0.847
OH-	0.845	F-	0.845	FE+++	0.288	AL+++	0.288
H3SI04-	0.847	CL-	0.842	FE0H+	0.852	ALOH++	0.535
H2SI04--	0.535	NA+	0.847	FE(OH)3-	0.852	AL(OH)2+	0.854
H2BO3-	0.839	K+	0.842	FE(OH)4--	0.531	AL(OH)4-	0.850
HCO3-	0.847	CA++	0.542	FE0H++	0.531	ALSO4+	0.850
CO3--	0.525	MG++	0.564	FE(OH)2+	0.854	AL(SO4)2-	0.850
HS-	0.845	CAHCO3+	0.857	FE(OH)4-	0.854	ALF++	0.535
S--	0.531	MGHCO3+	0.847	FES04+	0.852	ALF2+	0.854
HSO4-	0.850	CAOH+	0.857	FECL++	0.531	ALF4-	0.850
SO4--	0.518	MGOH+	0.859	FECL2+	0.852	ALF5--	0.525
NASO4-	0.854	NH4+	0.839	FECL4-	0.847	ALF6---	0.235

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-6.930	MG++	64.09	-2.579	FE(OH)3	0.00	0.000
OH-	0.29	-4.772	NACL	0.09	-5.828	FE(OH)4-	0.00	0.000
H4SI04	155.12	-2.792	KCL	0.00	-7.247	FECL+	0.00	0.000
H3SI04-	2.45	-4.590	NASO4-	0.03	-6.629	FECL2	0.00	0.000
H2SI04--	0.00	-8.388	KSO4+	0.02	-6.937	FECL++	0.00	0.000
NAH3SI04-	0.17	-5.833	CASO4	0.40	-5.529	FECL2+	0.00	0.000
H3BO3	4.97	-4.095	MGSO4	2.42	-4.697	FECL3	0.00	0.000
H2BO3-	0.06	-6.001	CACO3	5.78	-4.238	FECL4-	0.00	0.000
H2CO3	140.80	-2.644	MGCO3	1.70	-4.695	FES04	0.00	0.000
HCO3-	350.31	-2.241	CAHCO3+	93.33	-3.035	FES04+	0.00	0.000
CO3--	0.26	-5.359	MGHCO3+	21.90	-3.591	ALF++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.05	-6.071	ALOH++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.65	-4.803	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.137	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.590	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	1.05	-4.961	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.808	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.19	-5.001	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	30.44	-3.066	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	140.63	-2.213	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	24.19	-3.209	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	62.03	-2.810	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01569

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01630036
ANIONS (MOL.EQ.) 0.00668393
DIFFERENCE (%) 83.68

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.44

QUARTZ	135.6
CHALCEDONY	106.2
NAK	264.0

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-15.447	99.999	ALBITE LOW	-14.819	99.999
AMHYDRITE	-6.152	-8.323	CALCITE	-9.965	-8.715
MG-CHLORITE	-78.782	99.999	FLUORITE	-10.556	-13.224
LAUKONDITE	-24.678	99.999	MICROCLINE	-16.615	99.999
CA-MONTHOR.	-71.385	99.999	K-MONTHOR.	-34.542	99.999
NA-MONTHOR.	-34.423	99.999	MUSCOVITE	-17.969	99.999
PYRRHOTITE	1.038	99.999	PYRITE	-39.029	99.999
WAIKAKITE	-22.921	99.999	WOLLASTONITE	9.315	7.993
EPIDOTE	-138.734	99.999			
			ANALCIME	-11.765	99.999
			CHALCEDONY	-2.606	-2.792
			GOETHITE	-4.444	99.999
			MAGNETITE	-25.228	99.999
			MG-MONTHOR.	-72.270	99.999
			PREHNITE	-34.903	99.999
			QUARTZ	-2.772	-2.792
			ZOISITE	-33.986	99.999

ORKUSTOFNUN JHD
1980-11-14 HQRDUR

MADAGASCAR

7912210030

RANOMAFANA IFANADIANA (SOURCE 2A), FIANARANTSOA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

PH/DEG.C	9.30/26.0
SI02	38.60
NA	55.10
K	1.31
CA	3.10
MG	0.230
CO2	36.50
SO4	69.10
H2S	0.20
CL	3.10
F	2.28
DISS.SOLIDS	0.00
AL	0.0000
B	0.0100
FE	0.0000
NH3	0.0000
*	
*	
*	

STEAM SAMPLE

GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
CO2			
H2S	SAMPLING PRESSURE	BARS ABS.	
H2	DISCHARGE ENTHALPY	MJ/OL/KG	
O2	DISCHARGE	KG/SEC.	0.1
CH4			
N2	MEASURED TEMPERATURE	DEGREES C	55.0
	RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
	EH/TEMP.	MV/DEG.C	0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C

CONDENSATE (PPM)	0.0	0.0	0.0
PH/DEG.C	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
NA	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
CONDENSATE WITH NAOH (PPM)	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.00351

IONIC BALANCE : CATIONS (MOL.EQ.)0.00257875
ANIONS (MOL.EQ.)0.00270524
DIFFERENCE (%) -4.79

DEEP WATER (PPM)

SI02	38.60
NA	55.10
K	1.31
CA	3.10
MG	0.230
SO4	69.10
CL	3.10
F	2.28
DISS.S.	0.00
AL	0.0000
B	0.0100
FE	0.0000

DEEP STEAM (PPM)

CO2	36.50
H2S	0.20
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.399E-03
H2S	0.200E-05
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.488E+00
TOTAL	0.488E+00

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.937	KSO4-	0.933	FE++	0.760	FECL+	0.931
OH-	0.931	F-	0.931	FE+++	0.557	AL+++	0.557
H3SI04-	0.931	CL-	0.930	FE0H+	0.932	AL(OH)+	0.758
H2SI04--	0.758	NA+	0.931	FE(OH)3-	0.932	AL(OH)2+	0.933
H2BO3-	0.929	K+	0.930	FE(OH)4--	0.757	AL(OH)4-	0.932
HCO3-	0.931	CA++	0.760	FE0H++	0.757	ALSO4+	0.932
CO3--	0.755	MG++	0.768	FE(OH)2+	0.933	AL(SO4)2-	0.932
HS-	0.931	CAHCO3+	0.934	FE(OH)4-	0.933	ALF++	0.758
S--	0.757	MGHCO3+	0.931	FES04+	0.932	ALF2+	0.933
HSO4-	0.932	CAOH+	0.934	FECL++	0.757	ALF4-	0.932
SO4--	0.753	MGOH+	0.934	FECL2+	0.932	ALF5---	0.755
NASO4-	0.933	NH4+	0.929	FECL4-	0.931	ALF6---	0.531

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-8.512	MG++	0.17	-5.161	FE(OH)3	0.00	0.000
OH-	1.53	-4.047	NACL	0.00	-7.602	FE(OH)4-	0.00	0.000
H4SI04	48.66	-3.296	KCL	0.00	-9.785	FECL+	0.00	0.000
H3SI04-	12.58	-3.878	NASO4-	0.51	-5.366	FECL2	0.00	0.000
H2SI04--	0.04	-6.367	KSO4-	0.04	-6.568	FECL++	0.00	0.000
NAH3SI04-	0.41	-5.461	CASO4	0.82	-5.222	FECL2+	0.00	0.000
H3BO3	0.04	-6.169	MGSO4	0.26	-5.671	FECL3	0.00	0.000
H2BO3-	0.02	-6.608	CACD3	0.51	-5.297	FECL4-	0.00	0.000
H2CO3	0.31	-5.301	MGC03	0.02	-6.694	FES04	0.00	0.000
HCO3-	48.38	-3.101	CAHCO3+	0.20	-5.713	FES04+	0.00	0.000
CO3--	1.46	-4.615	MGHCO3+	0.01	-7.123	AL+++	0.00	0.000
H2S	0.00	-7.146	CAOH+	0.01	-6.880	ALOH++	0.00	0.000
HS-	0.19	-5.237	NGOH+	0.01	-6.831	AL(OH)2+	0.00	0.000
S--	0.00	-12.929	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-19.728	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-9.035	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	67.88	-3.151	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.807	FE0H+	0.00	0.000	ALF+	0.00	0.000
F-	2.28	-3.921	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	3.10	-4.058	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	54.92	-2.622	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	1.30	-4.478	FE(OH)4+	0.00	0.000	ALF5---	0.00	0.000
CA++	2.57	-4.192	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00343

IONIC BALANCE : CATIONS (MOL.EQ.)0.00256670
ANIONS (MOL.EQ.)0.00269098
DIFFERENCE (%) -4.73

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.83

QUARTZ	80.1
CHALCEDONY	50.1
NAK	83.1

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.419 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.			
ADULARIA	-17.912	99.999	ALBITE LOW	-17.097	99.999	ANALCIME	-13.595	99.999
ANHYDRITE	-5.344	-7.585	CALCITE	-9.039	-9.048	CHALCEDONY	-3.007	-3.296
MG-CHLORITE	-80.666	99.999	FLUORITE	-10.574	-12.215	GOETHITE	-6.755	99.999
LAUMONDITE	-27.976	99.999	MICROCLINE	-19.430	99.999	MAGNETITE	-29.456	99.999
CA-MONTHOR.	-89.471	99.999	K-MONTHOR.	-44.119	99.999	MG-MONTHOR.	-90.432	99.999
NA-MONTHOR.	-43.760	99.999	MUSCOVITE	-22.184	99.999	PREHNITE	-37.345	99.999
PYRRHOTITE	1.410	99.999	PYRITE	-45.589	99.999	QUARTZ	-3.268	-3.296
WAIKAKITE	-25.067	99.999	WOLLASTONITE	10.874	9.417	ZOISITE	-36.340	99.999
EPIDOTE	-141.869	99.999						

ORKUSTOFNUM JHD
1980-11-14 HQRDUR

MADAGASCAR

8002020037

RANOMAFANA TSARIPIOKA (NOSY AMBOSITRA), TOLIARY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	7.13/28.0	GAS (VOL.Z)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
SI02	36.10	CO2			
NA	670.90	H2S	SAMPLING PRESSURE	BAR ABS.	
K	40.20	H2	DISCHARGE ENTHALPY	MJ/OL/KG	
CA	28.90	O2	DISCHARGE	KG/SEC.	10.0
MG	9.500	CH4			
CO2	965.00	N2	MEASURED TEMPERATURE	DEGREES C	48.5
SO4	19.60		RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
H2S	0.17		EH/TEMP.	MV/DEG.C	0.000/ 0.0
CL	454.50				
F	0.86	LITERS GAS PER 'KG			
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	MEASURED DOWNHOLE TEMP.	FLUID INFLOW	
AL	0.0000		DEGREES C/METERS	DEPTH (METERS)	
B	1.3500				
FE	0.0000	CONDENSATE (PPM)			
NH3	0.0000	PH/DEG.C			
*		CO2			
*		H2S			
*		NA			

IONIC STRENGTH = 0.03346

IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.03227574
 ANIONS (MOL.EQ.) 0.03226209
 DIFFERENCE (%) 0.04

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	36.10	CO2	965.00	CO2	0.00	CO2	0.246E+00
NA	670.90	H2S	0.17	H2S	0.00	H2S	0.320E-04
K	40.20	H2	0.00	H2	0.00	H2	0.000E+00
CA	28.90	O2	0.00	O2	0.00	O2	0.000E+00
MG	9.499	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	19.60	N2	0.00	N2	0.00	N2	0.000E+00
CL	454.46	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	0.86					H2O	0.630E+00
DISS.S.	0.00					TOTAL	0.876E+00
AL	0.0000						
B	1.3499			H2O (Z)	0.00		
FE	0.0000			BOILING PORTION	0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.853	KS04-	0.832	FE++	0.493	FECL+	0.821
OH-	0.817	F-	0.817	FE+++	0.247	AL+++	0.247
H3SI04-	0.821	CL-	0.813	FE0H+	0.829	AL0H++	0.483
H2SI04--	0.483	NA+	0.821	FE(OH)3-	0.829	AL(OH)2+	0.832
H2B03-	0.809	K+	0.813	FE(OH)4--	0.477	AL(OH)4-	0.825
HCO3-	0.321	CA++	0.493	FE0H++	0.477	ALSO4+	0.825
CO3--	0.468	MG++	0.522	FE(OH)2+	0.832	AL(SO4)2-	0.825
HS-	0.817	CAHCO3+	0.836	FE(OH)4-	0.832	ALF++	0.483
S--	0.477	MGHCO3+	0.821	FES04+	0.829	ALF2+	0.832
HS04-	0.825	CAOH+	0.836	FECL++	0.477	ALF4-	0.825
SO4--	0.459	NGOH+	0.839	FECL2+	0.829	ALF5--	0.468
NAS04-	0.832	NH4+	0.809	FECL4-	0.821	ALF6---	0.182

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.091	MG++	7.65	-3.502	FE(OH)3	0.00	0.000
OH-	0.09	-5.293	NACL	2.37	-4.391	FE(OH)4-	0.00	0.000
H4SI04	56.84	-3.228	KCL	0.05	-6.206	FECL+	0.00	0.000
H3SI04-	0.72	-5.119	NAS04-	1.03	-5.064	FECL2	0.00	0.000
H2SI04--	0.00	-8.848	KS04-	0.19	-5.862	FECL1+	0.00	0.000
NAH3SI04-	0.22	-5.725	CAS04	0.63	-5.332	FECL2+	0.00	0.000
H3B03	7.60	-3.911	MGSD4	1.41	-4.930	FECL3	0.00	0.000
H2B03-	0.12	-5.693	CAC03	2.18	-4.662	FECL4-	0.00	0.000
H2CO3	176.91	-2.545	MGC03	0.47	-5.257	FES04	0.00	0.000
HCO3-	1142.04	-1.720	CAHCO3+	24.52	-3.615	FES04+	0.00	0.000
CO3--	1.85	-4.510	MGHCO3+	4.98	-4.234	AL+++	0.00	0.000
H2S	0.04	-5.972	CAOH+	0.00	-7.443	ALOH++	0.00	0.000
HS-	0.13	-5.407	NGOH+	0.01	-6.563	AL(OH)2+	0.00	0.000
S--	0.00	-14.300	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.532	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HS04-	0.00	-8.287	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	17.06	-3.751	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
NH	0.00	-7.806	FE0H+	0.00	0.000	ALF1+	0.00	0.000
F-	0.86	-4.344	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	453.00	-1.894	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	669.72	-1.536	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	40.12	-2.989	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	18.12	-3.345	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.03296

IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.03199222
 ANIONS (MOL.EQ.) 0.03197526
 DIFFERENCE (%) 0.05

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.77

QUARTZ	86.6
CHALCEDONY	56.7
NAK	149.7

OXIDATION POTENTIAL (VOLTS) :
 EH H2S= -0.324 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-17.595	99.999	ALBITE LOW	-16.807	99.999
ANHYDRITE	-5.430	-7.740	CALCITE	-9.132	-8.492
MG-CHLORITE	-80.342	99.999	FLUORITE	-10.558	-12.516
LAUMONDITE	-27.560	99.999	MICROCLINE	-19.065	99.999
CA-MONTHOR.	-87.301	99.999	K-MONTHOR.	-42.962	99.999
NA-MONTHOR.	-42.636	99.999	MUSCOVITE	-21.668	99.999
PYRRHOTITE	1.356	99.999	PYRITE	-44.730	99.999
WAIKAKITE	-24.800	99.999	WOLLASTONITE	10.668	7.302
EPIDOTE	-141.293	99.999	ANALCINE	-13.361	99.999
			CHALCEDONY	-2.954	-3.228
			GOETHITE	-6.495	99.999
			MAGNETITE	-28.971	99.999
			MG-MONTHOR.	-88.270	99.999
			PREHNITE	-37.018	99.999
			QUARTZ	-3.200	-3.228
			ZOISITE	-36.044	99.999

ORKUSTOFNUN JHD
1980-11-14 HORDUR

MADAGASCAR

8003060044

TSIEFA ANDRANONAFANA, FIAMARANTSOA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	7.55/21.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
SI02	29.50	CO2			
NA	144.00	H2S	SAMPLING PRESSURE	BARS ABS.	
K	5.30	H2	DISCHARGE ENTHALPY	KJOUL/KG	
CA	341.90	O2	DISCHARGE	KG/SEC.	0.5
MG	0.650	CH4			
CO2	11.40	N2	MEASURED TEMPERATURE	DEGREES C	50.0
SO4	1098.60		RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
H2S	2.86		EH/TEMP.	MV/DEG.C	0.000/ 0.0
CL	35.30				

F	2.88	LITERS GAS PER 'KG	MEASURED DOWNHOLE TEMP.	FLUID INFLOW
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	DEGREES C/METERS	DEPTH (METERS)
AL	0.0000			
B	0.1300	CONDENSATE (PPM)		
FE	0.0000	PH/DEG.C		
NH3	0.0000	CO2		
*		H2S		
*		NA		
		CONDENSATE WITH NAOH (PPM)		
		CO2		
		H2S		

IONIC STRENGTH = 0.03693

IONIC BALANCE : CATIONS (MOL.EQ.)0.02003117
 ANIONS (MOL.EQ.)0.02080153
 DIFFERENCE (%) -3.77

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	29.50	CO2	11.40	CO2	0.00	CO2	0.198E-02
NA	144.00	H2S	2.86	H2S	0.00	H2S	0.461E-03
K	5.30	H2	0.00	H2	0.00	H2	0.000E+00
CA	341.90	O2	0.00	O2	0.00	O2	0.000E+00
MG	0.650	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	1098.58	N2	0.00	N2	0.00	N2	0.000E+00
CL	35.30	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	2.88					H2O	0.448E+00
DISS.S.	0.00					TOTAL	0.451E+00
AL	0.0000						
B	0.1300					H2O (%)	0.00
FE	0.0000					BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.856	KS04--	0.835	FE++	0.500	FECL+	0.825
OH-	0.821	F-	0.821	FE+++	0.254	AL+++	0.254
H3SI04-	0.825	CL-	0.816	FE0H+	0.832	AL0H++	0.490
H2SI04--	0.490	NA+	0.825	FE(OH)3-	0.832	AL(OH)2+	0.835
H2BO3-	0.812	K+	0.816	FE(OH)4--	0.484	AL(OH)4-	0.828
HCO3-	0.825	CA++	0.500	FE0H++	0.484	ALSO4+	0.828
CO3--	0.476	MG++	0.529	FE(OH)2+	0.835	AL(SO4)2-	0.828
HS-	0.821	CAHCO3+	0.839	FE(OH)4-	0.835	ALF++	0.490
S--	0.484	MGHCO3+	0.825	FES04+	0.832	ALF2+	0.835
HSO4-	0.828	CAOH+	0.839	FECL++	0.484	ALF4-	0.828
SO4--	0.467	MGOH+	0.842	FECL2+	0.832	ALF5--	0.476
NASO4-	0.835	NH4+	0.812	FECL4-	0.825	ALF6---	0.189

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.154	MG++	0.25	-4.980	FE(OH)3	0.00	0.000
OH-	0.07	-5.390	NACL	0.03	-6.267	FE(OH)4-	0.00	0.000
H4SI04	46.59	-3.315	KCL	0.00	-8.270	FECL+	0.00	0.000
H3SI04-	0.57	-5.223	NASO4-	9.74	-4.087	FECL2	0.00	0.000
H2SI04--	0.00	-8.947	KS04-	1.02	-5.121	FECL++	0.00	0.000
NAH3SI04-	0.04	-6.497	CASO4	360.33	-2.577	FECL2+	0.00	0.000
H3BO3	0.73	-4.928	MGSO4	1.95	-4.790	FECL3	0.00	0.000
H2BO3-	0.01	-6.672	CACO3	0.28	-5.549	FECL4-	0.00	0.000
H2CO3	1.58	-4.593	MGCO3	0.00	-8.693	FES04	0.00	0.000
HCO3-	12.36	-3.693	CAHCO3+	2.80	-4.558	FES04+	0.00	0.000
CO3--	0.02	-6.419	MGHCO3+	0.00	-7.703	AL+++	0.00	0.000
H2S	0.58	-4.772	CAOH+	0.02	-6.465	AL0H++	0.00	0.000
HS-	2.22	-4.174	MGOH+	0.00	-8.175	AL(OH)2+	0.00	0.000
S--	0.00	-13.109	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-16.184	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.02	-6.773	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	834.16	-2.061	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.422	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	2.88	-3.819	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	35.28	-3.002	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	142.10	-2.209	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	5.00	-3.893	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	234.58	-2.233	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.03298

IONIC BALANCE : CATIONS (MOL.EQ.)0.01806357
 ANIONS (MOL.EQ.)0.01879494
 DIFFERENCE (%) -3.97

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.84

QUARTZ	78.3
CHALCEDONY	48.4
NAK	108.6

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.310 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

ADULARIA	TEOR. -18.017	CALC. 99.999	ALBITE LOW	TEOR. -17.193	CALC. 99.999	ANALCINE	TEOR. -13.673	CALC. 99.999
ANHYDRITE	TEOR. -5.316	CALC. -4.926	CALCITE	TEOR. -9.010	CALC. -9.275	CHALCEDONY	TEOR. -3.025	CALC. -3.315
MG-CHLORITE	TEOR. -80.778	CALC. 99.999	FLUORITE	TEOR. -10.580	CALC. -10.344	GOETHITE	TEOR. -6.839	CALC. 99.999
LAUNDRONITE	TEOR. -28.113	CALC. 99.999	MICROCLINE	TEOR. -19.550	CALC. 99.999	MAGNETITE	TEOR. -29.614	CALC. 99.999
CA-MONTHOR.	TEOR. -90.176	CALC. 99.999	K-MONTHOR.	TEOR. -44.498	CALC. 99.999	MG-MONTHOR.	TEOR. -91.135	CALC. 99.999
NA-MONTHOR.	TEOR. -44.126	CALC. 99.999	MUSCOVITE	TEOR. -22.352	CALC. 99.999	PREHNITE	TEOR. -37.453	CALC. 99.999
PYRRHOTITE	TEOR. 1.429	CALC. 99.999	PYRITE	TEOR. -45.873	CALC. 99.999	QUARTZ	TEOR. -3.290	CALC. -3.315
MAIRAKITE	TEOR. -25.156	CALC. 99.999	WOLLASTONITE	TEOR. 10.943	CALC. 8.460	ZOISITE	TEOR. -36.438	CALC. 99.999
EPIDOTE	TEOR. -142.069	CALC. 99.999						

ORKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

8003140050

RAHOMAFAMA D'ANJOHIBE, ANTANANARIVO, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	8.53/21.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
SI02	45.00	CO2			
NA	220.70	H2S	SAMPLING PRESSURE	BARS ABS.	
K	5.90	H2	DISCHARGE ENTHALPY	MJ/OL/KG	
CA	81.10	O2	DISCHARGE	KG/SEC.	2.0
MG	0.470	CH4			
CO2	17.20	N2	MEASURED TEMPERATURE	DEGREES C	50.0
SO4	496.70		RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
H2S	0.10		EH/TEMP.	MV/DEG.C	0.000/ 0.0
CL	89.50				
F	6.20				
DISS.SOLIDS	0.00				
AL	0.0000				
B	0.0900				
FE	0.0000				
NH3	0.0000				

LITERS GAS PER 'KG
CONDENSATE/DEG.C

MEASURED DOWNHOLE TEMP.
DEGREES C/METERS

FLUID INFLOW
DEPTH (METERS)

CONDENSATE (PPM)	0.0	0.0	0.0
PH/DEG.C	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
NA	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
CONDENSATE WITH NAOH (PPM)	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.01963

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01317868
ANIONS (MOL.EQ.) 0.01292985
DIFFERENCE (%) 1.91

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	45.00	CO2	17.20	CO2	0.00	CO2	0.174E-02
NA	220.70	H2S	0.10	H2S	0.00	H2S	0.759E-05
K	5.90	H2	0.00	H2	0.00	H2	0.000E+00
CA	81.10	O2	0.00	O2	0.00	O2	0.000E+00
MG	0.470	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	496.69	N2	0.00	N2	0.00	N2	0.000E+00
CL	89.49	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	6.20					H2O	0.852E+00
DISS.S.	0.00					TOTAL	0.854E+00
AL	0.0000						
B	0.0900					H2O (%)	0.00
FE	0.0000					BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.876	KSO4-	0.861	FE++	0.561	FECL+	0.855
OH-	0.852	F-	0.852	FE+++	0.310	AL+++	0.310
H3SI04-	0.855	CL-	0.849	FE0H+	0.860	AL0H++	0.554
H2SI04--	0.554	NA+	0.855	FE(OH)3-	0.860	AL(OH)2+	0.861
H2BO3-	0.846	K+	0.849	FE(OH)4--	0.549	AL(OH)4-	0.857
HCO3-	0.855	CA++	0.561	FE0H++	0.549	ALSO4+	0.857
CO3--	0.543	MG++	0.583	FE(OH)2+	0.861	AL(SO4)2--	0.857
HS-	0.852	CANCO3+	0.864	FE(OH)4-	0.861	ALF++	0.554
S--	0.549	MGHCO3+	0.855	FESO4+	0.860	ALF2+	0.861
HSO4-	0.857	CAOH+	0.864	FECL++	0.549	ALF4-	0.857
SO4--	0.536	MGOH+	0.866	FECL2+	0.860	ALF5--	0.543
NASO4-	0.861	NH4+	0.846	FECL4-	0.855	ALF6---	0.253

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.592	MG++	0.19	-5.107	FE(OH)3	0.00	0.000
OH-	0.36	-4.674	NACL	0.20	-5.464	FE(OH)4-	0.00	0.000
H4SI04	68.60	-3.146	KCL	0.00	-7.673	FECL+	0.00	0.000
H3SI04-	3.08	-4.490	NASO4-	10.98	-4.035	FECL2	0.00	0.000
H2SI04--	0.00	-7.720	KSO4-	0.87	-5.191	FECL++	0.00	0.000
NAH3SI04-	0.33	-5.549	CASO4	77.17	-3.247	FECL2+	0.00	0.000
H3BO3	0.49	-5.102	HSSO4	1.38	-4.941	FECL3	0.00	0.000
H2BO3-	0.02	-6.386	CACO3	0.59	-5.230	FECL4-	0.00	0.000
H2CO3	1.14	-4.736	MGCO3	0.00	-7.978	FESO4	0.00	0.000
HCO3-	21.06	-3.462	CANCO3+	2.01	-4.702	FESO4+	0.00	0.000
CO3--	0.10	-5.798	MGHCO3+	0.00	-7.495	AL+++	0.00	0.000
H2S	0.01	-6.634	CAOH+	0.03	-6.222	AL0H++	0.00	0.000
HS-	0.09	-5.568	MGOH+	0.00	-7.458	AL(OH)2+	0.00	0.000
S--	0.00	-13.916	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-16.857	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.01	-7.222	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	431.65	-2.347	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.356	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	6.20	-3.486	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	89.37	-2.598	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	218.44	-2.022	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	5.65	-3.840	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	57.32	-2.845	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01832

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01254240
ANIONS (MOL.EQ.) 0.01223947
DIFFERENCE (%) 2.44

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	94.9
CHALCEDONY	64.9
NAK	88.3

1000/T DEGREES KELVIN = 2.71

OXIDATION POTENTIAL (VOLTS) :
EH H2S= -0.364 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

ADULARIA	TEOR. -17.215	CALC. 99.999	ALBITE LOW	TEOR. -16.458	CALC. 99.999	ANALCINE	TEOR. -13.080	CALC. 99.999
AMHYDRITE	TEOR. -5.540	CALC. -5.714	CALCITE	TEOR. -9.252	CALC. -9.159	CHALCEDONY	TEOR. -2.891	CALC. -3.146
MG-CHLORITE	TEOR. -79.984	CALC. 99.999	FLUORITE	TEOR. -10.545	CALC. -10.208	GOETHITE	TEOR. -6.172	CALC. 99.999
LAUMONDITE	TEOR. -27.059	CALC. 99.999	MICROCLINE	TEOR. -18.630	CALC. 99.999	MAGNETITE	TEOR. -28.371	CALC. 99.999
CA-MONTHOR.	TEOR. -84.643	CALC. 99.999	K-MONTHOR.	TEOR. -41.544	CALC. 99.999	MG-MONTHOR.	TEOR. -85.613	CALC. 99.999
NA-MONTHOR.	TEOR. -41.259	CALC. 99.999	MUSCOVITE	TEOR. -21.041	CALC. 99.999	PREHNITE	TEOR. -36.632	CALC. 99.999
PYRRHOTITE	TEOR. 1.292	CALC. 99.999	PYRITE	TEOR. -43.705	CALC. 99.999	QUARTZ	TEOR. -3.121	CALC. -3.146
MAIRAKITE	TEOR. -24.475	CALC. 99.999	WOLLASTONITE	TEOR. 10.423	CALC. 8.941	ZOISITE	TEOR. -35.680	CALC. 99.999
EPIDOTE	TEOR. -140.663	CALC. 99.999						

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

8003210052 SOURCE DE MAHATSINJE AMBOHIPANO, ANTANANARIVO, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE	
PH/DEG.C	6.79/29.0	GAS (VOL.%)	REFERENCE TEMP. DEGREES C 0.0 (RTZ)
SI02	98.00	CO2	
NA	392.90	H2S	SAMPLING PRESSURE BARS ABS.
K	18.30	H2	DISCHARGE ENTHALPY MJ/OL/KG
CA	205.80	O2	DISCHARGE KG/SEC. 2.0
MG	7.740	CH4	
CO2	715.10	N2	MEASURED TEMPERATURE DEGREES C 40.0
SO4	942.30		RESISTIVITY/TEMP. OHMM/DEG.C 0.0/ 0.0
H2S	0.00		EH/TEMP. MV/DEG.C 0.000/ 0.0
CL	57.80		
F	2.12	LITERS GAS PER 'KG	MEASURED DOWNHOLE TEMP. DEGREES C/METERS
DISS.SOLIDS	0.00	CONDENSATE/DEG.C /	FLUID INFLOW DEPTH (METERS)
AL	0.0000		
B	0.0800	CONDENSATE (PPM)	0.0 0.0 0.0
FE	0.0000	PH/DEG.C /	0.0 0.0 0.0
NH3	0.0000	CO2	0.0 0.0 0.0
H2S	<0.14	H2S	0.0 0.0 0.0
*		NA	0.0 0.0 0.0
*			0.0 0.0 0.0
			0.0 0.0 0.0
			0.0 0.0 0.0
		CONDENSATE WITH NAOH (PPM)	0.0 0.0 0.0
		CO2	0.0 0.0 0.0
		H2S	0.0 0.0 0.0

IONIC STRENGTH = 0.04147

IONIC BALANCE :
 CATIONS (MDL.EQ.) 0.02602522
 ANIONS (MDL.EQ.) 0.03123066
 DIFFERENCE (%) -18.18

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	98.01	CO2	715.10	CO2	0.511E+00
NA	392.90	H2S	0.00	H2S	0.000E+00
K	18.30	H2	0.00	H2	0.000E+00
CA	205.80	O2	0.00	O2	0.000E+00
MG	7.739	CH4	0.00	CH4	0.000E+00
SO4	942.28	N2	0.00	N2	0.000E+00
CL	57.80	NH3	0.00	NH3	0.000E+00
F	2.12			H2O	0.324E+01
DISS.S.	0.00			TOTAL	0.375E+01
AL	0.0000				
B	0.0800				
FE	0.0000				
		H2O (%)	0.00		
		BOILING PORTION	0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.832	KSO4-	0.806	FE++	0.437	FECL+	0.794
OH-	0.789	F-	0.789	FE+++	0.196	AL+++	0.196
H3SI04-	0.794	CL-	0.784	FE0H+	0.803	ALOH++	0.427
H2SI04--	0.427	NA+	0.794	FE(OH)3-	0.803	AL(OH)2+	0.806
H2BO3-	0.779	K+	0.784	FE(OH)4--	0.420	AL(OH)4-	0.798
HCO3-	0.794	CA++	0.437	FE0H++	0.420	ALSO4+	0.798
CO3--	0.411	MG++	0.469	FE(OH)2+	0.806	AL(SO4)2-	0.798
HS-	0.789	CAHCO3+	0.811	FE(OH)4-	0.806	ALF++	0.427
S--	0.420	MGHCO3+	0.794	FES04+	0.803	ALF2+	0.806
H3O4-	0.798	CAOH+	0.811	FECL++	0.420	ALF4-	0.798
SO4--	0.402	MGOH+	0.815	FECL2+	0.803	ALF5--	0.411
NASO4-	0.806	NH4+	0.779	FECL4-	0.794	ALF6---	0.136

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-6.922	MG++	1.69	-4.158	FE(OH)3	0.00	0.000
OH-	0.30	-4.754	NACL	0.39	-5.175	FE(OH)4-	0.00	0.000
H4SI04	153.86	-2.796	KCL	0.00	-7.197	FECL+	0.00	0.000
H3SI04-	2.54	-4.574	NASO4-	40.94	-3.464	FECL2	0.00	0.000
H2SI04--	0.00	-8.310	KSO4-	5.72	-4.374	FECL++	0.00	0.000
NAH3SI04-	0.43	-5.437	CASO4	210.74	-2.810	FECL2+	0.00	0.000
H3BO3	0.45	-5.136	MGSO4	28.58	-3.625	FECL3	0.00	0.000
H2BO3-	0.01	-7.018	CACO3	9.45	-4.025	FECL4-	0.00	0.000
H2CO3	245.61	-2.402	MGCO3	0.06	-6.127	FES04	0.00	0.000
HCO3-	643.83	-1.977	CAHCO3+	164.07	-2.790	FES04+	0.00	0.000
CO3--	0.57	-5.023	MGHCO3+	0.88	-4.987	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.05	-6.073	ALOH++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.01	-6.453	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-14.396	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
H3O4-	0.14	-5.827	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	733.53	-2.117	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-6.785	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	2.12	-3.953	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	57.56	-2.790	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	384.76	-1.776	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	16.64	-3.371	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	74.90	-2.728	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.03473

IONIC BALANCE :
 CATIONS (MDL.EQ.) 0.02267218
 ANIONS (MDL.EQ.) 0.02762174
 DIFFERENCE (%) -19.68

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	135.2
CHALCEDONY	105.8
NAK	123.3

1000/T DEGREES KELVIN = 2.44

OXIDATION POTENTIAL (VOLTS) :
 EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-15.460	99.999	ALBITE LOW	-14.832	99.999	ANALCIME	-11.776	99.999
ANHYDRITE	-6.146	-5.601	CALCITE	-9.958	-8.497	CHALCEDONY	-2.608	-2.796
MG-CHLORITE	-78.788	99.999	FLUORITE	-10.556	-11.199	GOETHITE	-4.459	99.999
LAUMONDITE	-24.696	99.999	MICROCLINE	-16.631	99.999	MAGNETITE	-25.255	99.999
CA-MONTMOR.	-71.494	99.999	K-MONTMOR.	-34.599	99.999	MG-MONTMOR.	-72.379	99.999
NA-MONTMOR.	-34.478	99.999	MUSCOVITE	-17.993	99.999	PREHNITE	-34.916	99.999
PYRRHOTITE	1.040	99.999	PYRITE	-39.064	99.999	QUARTZ	-2.774	-2.796
WAIRAKITE	-22.934	99.999	WOLLASTONITE	9.323	7.962	ZOISITE	-33.999	99.999
EPIDOTE	-138.742	99.999						

ORKUSTOFNUM JHD
1980-11-21 HORDUR

MADAGASCAR

B003300059 RANOMAFANA AMPASIMIHERO, FIANARANTSOA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE		REFERENCE TEMP.		DEGREES C		0.0 (QTZ)	
PH/DEG.C	7.65/24.0	GAS (VOL.%)							
SI02	63.40	CO2							
NA	156.90	H2S		SAMPLING PRESSURE	BARS ABS.				
K	9.90	H2		DISCHARGE ENTHALPY	MJ/OU/L/KG				
CA	183.20	O2		DISCHARGE	KG/SEC.	2.0			
MG	0.110	CH4							
CO2	14.20	N2		MEASURED TEMPERATURE	DEGREES C	42.0			
SO4	731.70			RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0			
H2S	0.27			EH/TEMP.	MV/DEG.C	0.000/ 0.0			
CL	10.90								
F	3.99	LITERS GAS PER 'KG							
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	/	MEASURED DOWNHOLE TEMP.	DEGREES C/METERS		FLUID INFLOW	DEPTH (METERS)	
AL	0.0000								
B	0.1700	CONDENSATE (PPM)							
FE	0.0000	PH/DEG.C	/						
NH3	0.0000	CO2							
*		H2S							
*		NA							
*									
		CONDENSATE WITH NaOH (PPM)							
		CO2							
		H2S							

IDNIC STRENGTH = 0.02493

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01452917
ANIONS (MOL.EQ.) 0.01432975
DIFFERENCE (%) 1.38

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	63.41	CO2	14.20	CO2	0.493E-02
NA	156.90	H2S	0.27	H2S	0.588E-04
K	9.90	H2	0.00	H2	0.000E+00
CA	183.20	O2	0.00	O2	0.000E+00
MG	0.110	CH4	0.00	CH4	0.000E+00
SO4	731.68	N2	0.00	N2	0.000E+00
CL	10.90	NH3	0.00	NH3	0.000E+00
F	3.99			H2O	0.159E+01
DISS.S.	0.00			TOTAL	0.159E+01
AL	0.0000				
B	0.1700	H2O (%)	0.00		
FE	0.0000	BOILING PORTION	0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.864	KS04-	0.847	FE++	0.526	FECL+	0.839
OH-	0.836	F-	0.836	FE+++	0.274	AL+++	0.274
H3SI04-	0.839	CL-	0.833	FE0H+	0.845	ALOH++	0.518
H2SI04--	0.518	NA+	0.839	FE(OH)3-	0.845	AL(OH)2+	0.847
H2BO3-	0.829	K+	0.833	FE(OH)4--	0.513	AL(OH)4-	0.842
HCO3-	0.839	CA++	0.526	FE0H++	0.513	ALSO4+	0.842
CO3--	0.506	MG++	0.551	FE(OH)2+	0.847	AL(SO4)2-	0.842
HS-	0.836	CAHCO3+	0.850	FE(OH)4-	0.847	ALF++	0.518
S--	0.513	MGHCO3+	0.839	FES04+	0.845	ALF2+	0.847
HSO4-	0.842	CAOH+	0.850	FECL++	0.513	ALF4-	0.842
SO4--	0.499	MGOH+	0.853	FECL2+	0.845	ALF5--	0.506
NAS04-	0.847	NH4+	0.829	FECL4-	0.839	ALF6---	0.216

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.116	MG++	0.03	-5.878	FE(OH)3	0.00	0.000
OH-	0.23	-4.872	NACL	0.02	-6.389	FE(OH)4-	0.00	0.000
H4SI04	99.31	-2.986	KCL	0.00	-8.274	FECL+	0.00	0.000
H3SI04-	1.97	-4.684	NAS04-	11.61	-4.011	FECL2	0.00	0.000
H2SI04--	0.00	-8.310	KS04-	2.18	-4.792	FECL++	0.00	0.000
NAH3SI04-	0.15	-5.906	CAS04	233.28	-2.766	FECL2+	0.00	0.000
H3BO3	0.95	-4.812	MGS04	0.38	-5.496	FECL3	0.00	0.000
H2BO3-	0.02	-6.537	CAC03	0.38	-5.422	FECL4-	0.00	0.000
H2CO3	2.73	-4.357	MGCO3	0.00	-9.318	FES04	0.00	0.000
HCO3-	14.39	-3.627	CAHCO3+	3.91	-4.413	FES04+	0.00	0.000
CO3--	0.02	-6.455	MGHCO3+	0.00	-8.385	AL+++	0.00	0.000
H2S	0.05	-5.809	CAOH+	0.05	-6.060	ALOH++	0.00	0.000
HS-	0.21	-5.196	MGOH+	0.00	-8.357	AL(OH)2+	0.00	0.000
S--	0.00	-13.813	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-15.377	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.04	-6.407	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	555.81	-2.238	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-6.908	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	3.99	-3.678	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	10.88	-3.513	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	154.62	-2.172	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	9.27	-3.625	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	112.79	-2.551	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.02110

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01263271
ANIONS (MOL.EQ.) 0.01236647
DIFFERENCE (%) 2.13

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	112.3
CHALCEDONY	82.5
NAK	150.0

1000/T DEGREES KELVIN = 2.59

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.359 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-16.413	99.999	ALBITE LOW	-15.718	99.999
ANHYDRITE	-5.795	-5.369	CALCITE	-9.541	-9.580
MG-CHLORITE	-79.341	99.999	FLUORITE	-10.534	-10.341
LAUMONDITE	-25.988	99.999	MICROCLINE	-17.714	99.999
CA-MONTMOR.	-78.813	99.999	K-MONTMOR.	-38.455	99.999
NA-MONTMOR.	-38.248	99.999	MUSCOVITE	-19.680	99.999
PYRRHOTITE	1.168	99.999	PYRITE	-41.567	99.999
WAIKAKITE	-23.779	99.999	WOLLASTONITE	9.914	8.417
EPIDOTE	-139.573	99.999			
			ANALCIME	-12.485	99.999
			CHALCEDONY	-2.760	-2.986
			GOETHITE	-5.441	99.999
			MAGNETITE	-27.026	99.999
			MG-MONTMOR.	-79.760	99.999
			PREHNITE	-35.833	99.999
			QUARTZ	-2.958	-2.986
			ZOISITE	-34.923	99.999

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

8004030065

RANOMAFANA IMODY, FIANARANTSOA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPH)

STEAM SAMPLE

PH/DEG.C	9.21/19.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (0TZ)
SiO2	54.40	CO2	SAMPLING PRESSURE	BARS ABS.	
NA	92.10	H2S	DISCHARGE ENTHALPY	MJ/OL/KG	
K	3.40	H2	DISCHARGE	KG/SEC.	3.0
CA	6.40	O2	MEASURED TEMPERATURE	DEGREES C	48.0
MG	0.146	CH4	RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0
CO2	27.60	N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0
SO4	158.60				
H2S	0.20				
CL	10.70				
F	6.36				
DISS.SOLIDS	0.00				
AL	0.0000				
R	0.0800				
FE	0.0000				
NH3	0.0000				
*					
*					
*					

LITERS GAS PER 'KG

CONDENSATE/DEG.C

MEASURED DOWNHOLE TEMP.
DEGREES C/METERS

FLUID INFLOW
DEPTH (METERS)

CONDENSATE (PPH)

PH/DEG.C

CO2

H2S

NA

CONDENSATE WITH NAOH (PPH)

CO2

H2S

0.0

0.0

0.0

0.0

0.0

0.0

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0.0

0.0

IONIC STRENGTH = 0.00637

IONIC BALANCE :

CATIONS (MOL.EQ.) 0.00437565

ANIONS (MOL.EQ.) 0.00471270

DIFFERENCE (%) -7.42

DEEP WATER (PPH)

DEEP STEAM (PPH)

GAS PRESSURES (BARS ABS.)

SiO2	54.40	CO2	27.60	CO2	0.00	CO2	0.109E-02
NA	92.10	H2S	0.20	H2S	0.00	H2S	0.545E-05
K	3.40	H2	0.00	H2	0.00	H2	0.000E+00
CA	6.40	O2	0.00	O2	0.00	O2	0.000E+00
MG	0.146	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	158.60	N2	0.00	N2	0.00	N2	0.000E+00
CL	10.70	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	6.36					H2O	0.987E+00
DISS.S.	0.00					TOTAL	0.988E+00
AL	0.0000						
R	0.0800						
FE	0.0000						
		H2O (%)			0.00		
		BOILING PORTION			0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.916	KSD4-	0.909	FE++	0.688	FECL+	0.906
OH-	0.905	F-	0.905	FE+++	0.456	AL+++	0.456
H3SiO4-	0.906	CL-	0.904	FE(OH)	0.908	AL(OH)+	0.684
H2SiO4--	0.684	NA+	0.906	FE(OH)3-	0.908	AL(OH)2+	0.909
H2BO3-	0.903	K+	0.904	FE(OH)4--	0.682	AL(OH)4-	0.907
HCO3-	0.906	CA++	0.688	FE(OH)2+	0.682	ALSO4+	0.907
CO3--	0.679	MG++	0.699	FE(OH)4-	0.909	AL(SO4)2-	0.907
HS-	0.905	CAHCO3+	0.910	FES04+	0.908	ALF++	0.684
S--	0.682	MGHCO3+	0.906	FECL+	0.682	ALF2+	0.909
HSO4-	0.907	CAOH+	0.910	FECL2+	0.908	ALF4-	0.907
SO4--	0.676	MGOH+	0.911	FECL4-	0.906	ALF5--	0.679
NASO4-	0.909	NH4+	0.903			ALF6---	0.419

CHEMICAL COMPONENTS IN DEEP WATER (PPH AND LOG MOLE)

H+ (ACT.)	0.00	-8.096	MG++	0.08	-5.500	FE(OH)3	0.00	0.000
OH-	1.26	-4.131	NACL	0.01	-6.672	FE(OH)4-	0.00	0.000
H4SiO4	75.51	-3.105	KCL	0.00	-8.745	FECL+	0.00	0.000
H3SiO4-	10.92	-3.940	NASO4-	2.18	-4.737	FECL2	0.00	0.000
H2SiO4--	0.02	-6.715	KSO4-	0.25	-5.741	FECL++	0.00	0.000
NAH3SiO4-	0.56	-5.325	CASO4	3.90	-4.543	FECL2+	0.00	0.000
H3RO3	0.40	-5.195	MGSO4	0.33	-5.565	FECL3	0.00	0.000
H2RO3-	0.06	-5.995	CACO3	0.41	-5.392	FECL4-	0.00	0.000
H2CO3	0.68	-4.959	MGCO3	0.00	-7.496	FES04	0.00	0.000
HCO3-	36.65	-3.221	CAHCO3+	0.41	-5.393	FES04+	0.00	0.000
CO3--	0.44	-5.130	MGHCO3+	0.00	-7.552	AL+++	0.00	0.000
H2S	0.01	-6.794	CAOH+	0.01	-6.632	ALOH++	0.00	0.000
HS-	0.19	-5.244	MGOH+	0.00	-7.202	AL(OH)2+	0.00	0.000
S--	0.00	-13.111	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-18.111	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.043	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	153.65	-2.796	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.784	FE(OH)	0.00	0.000	ALF++	0.00	0.000
F-	6.36	-3.475	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	10.69	-3.521	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	91.57	-2.400	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	3.33	-4.070	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	4.92	-3.911	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00622

IONIC BALANCE :

CATIONS (MOL.EQ.) 0.00432401

ANIONS (MOL.EQ.) 0.00464669

DIFFERENCE (%) -7.19

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.69

QUARTZ	99.3
CHALCEDONY	69.3
NAK	111.3

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.420 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-17.027	99.999	ALBITE LOW	-16.285	99.999	ANALCIME	-12.941	99.999
ANHYDRITE	-5.596	-7.040	CALCITE	-9.315	-9.372	CHALCEDONY	-2.860	-3.105
MG-CHLORITE	-79.820	99.999	FLUORITE	-10.540	-11.111	GOETHITE	-6.008	99.999
LAUMONITE	-26.809	99.999	MICROCLINE	-18.415	99.999	MAGNETITE	-28.066	99.999
CA-MONTHOR.	-83.307	99.999	K-MONTHOR.	-40.834	99.999	MG-MONTHOR.	-84.273	99.999
NA-MONTHOR.	-40.567	99.999	MUSCOVITE	-20.727	99.999	PREHNITE	-36.444	99.999
PYRRHOTITE	1.262	99.999	PYRITE	-43.202	99.999	QUARTZ	-3.082	-3.105
WAIRAKITE	-24.314	99.999	WOLLASTONITE	10.303	9.014	ZOISITE	-35.509	99.999
EPIDOTE	-140.379	99.999						

8004040067 SOURCE DE MAHASOA, FIANARANTSOA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	8.30/18.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
SI02	33.10	CO2			
NA	47.40	H2S	SAMPLING PRESSURE	BARS ABS.	
K	2.80	H2	DISCHARGE ENTHALPY	KJ/OL/KG	
CA	5.10	O2	DISCHARGE	KG/SEC.	0.5
MG	0.310	CH4			
CO2	14.50	N2	MEASURED TEMPERATURE	DEGREES C	28.0
SO4	74.90		RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
H2S	0.27		EH/TEMP.	MV/DEG.C	0.000/ 0.0
CL	114.30				
F	3.15				
DISS.SOLIDS	0.00				
AL	0.0000				
B	0.0500				
FE	0.0000				
NH3	0.0000				
*					
*					
*					

LITERS GAS PER 'KG
CONDENSATE/DEG.C

MEASURED DOWNHOLE TEMP.
DEGREES C/METERS

FLUID INFLOW
DEPTH (METERS)

CONDENSATE (PPM)

PH/DEG.C

CO2

H2S

NA

CONDENSATE WITH NAOH (PPM)

CO2

H2S

IONIC STRENGTH = 0.00475

IONIC BALANCE : CATIONS (MOL.EQ.)0.00239800
ANIONS (MOL.EQ.)0.00528017
DIFFERENCE (%) -75.07

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	33.10	CO2	14.50	CO2	0.00	CO2	0.145E-02
NA	47.40	H2S	0.27	H2S	0.00	H2S	0.223E-04
K	2.80	H2	0.00	H2	0.00	H2	0.000E+00
CA	5.10	O2	0.00	O2	0.00	O2	0.000E+00
MG	0.310	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	74.90	N2	0.00	N2	0.00	N2	0.000E+00
CL	114.29	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	3.15					H2O	0.531E+00
DISS.S.	0.00					TOTAL	0.532E+00
AL	0.0000						
B	0.0500					H2O (%)	0.00
FE	0.0000					BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.928	KSO4-	0.923	FE++	0.728	FECL+	0.920
OH-	0.920	F-	0.920	FE+++	0.511	AL+++	0.511
H3SI04-	0.920	CL-	0.919	FE0H+	0.922	AL0H++	0.726
H2SI04--	0.726	NA+	0.920	FE(OH)3-	0.922	AL(OH)2+	0.923
H2BO3-	0.918	K+	0.919	FE(OH)4--	0.724	AL(OH)4-	0.921
HCO3-	0.920	CA++	0.728	FE0H++	0.724	ALSO4+	0.921
CO3--	0.721	MG++	0.738	FE(OH)2+	0.923	AL(SO4)2-	0.921
HS-	0.920	CAHCO3+	0.924	FE(OH)4-	0.923	ALF++	0.726
S--	0.724	MGHCO3+	0.920	FES04+	0.922	ALF2+	0.923
HSO4-	0.921	CAOH+	0.924	FECL++	0.724	ALF4-	0.921
SO4--	0.719	MGOH+	0.924	FECL2+	0.922	ALF5--	0.721
NASO4-	0.923	NH4+	0.918	FECL4-	0.920	ALF6---	0.480

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.554	MG++	0.23	-5.018	FE(OH)3	0.00	0.000
OH-	0.19	-4.961	NACL	0.05	-6.087	FE(OH)4-	0.00	0.000
H4SI04	51.35	-3.272	KCL	0.00	-7.886	FECL+	0.00	0.000
H3SI04-	1.55	-4.788	NASO4-	0.47	-5.408	FECL2	0.00	0.000
H2SI04--	0.00	-8.208	KSO4-	0.08	-6.214	FECL++	0.00	0.000
NAH3SI04-	0.04	-6.446	CASO4	1.48	-4.963	FECL2+	0.00	0.000
H3BO3	0.27	-5.352	MGS04	0.37	-5.512	FECL3	0.00	0.000
H2BO3-	0.01	-6.738	CACO3	0.04	-6.411	FECL4-	0.00	0.000
H2CO3	1.10	-4.752	MGCO3	0.00	-7.925	FES04	0.00	0.000
HCO3-	18.85	-3.510	CAHCO3+	0.14	-5.867	FES04+	0.00	0.000
CO3--	0.06	-5.967	MGHCO3+	0.00	-7.398	AL+++	0.00	0.000
H2S	0.03	-6.110	CAOH+	0.00	-7.551	AL0H++	0.00	0.000
HS-	0.24	-5.146	MGOH+	0.00	-7.609	AL(OH)2+	0.00	0.000
S--	0.00	-13.757	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.745	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.032	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	73.12	-3.118	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.695	FEDH+	0.00	0.000	ALF++	0.00	0.000
F-	3.15	-3.780	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	114.26	-2.492	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	47.28	-2.687	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	2.78	-4.149	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	4.59	-3.941	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00470

IONIC BALANCE : CATIONS (MOL.EQ.)0.00237746
ANIONS (MOL.EQ.)0.00525697
DIFFERENCE (%) -75.43

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.81

QUARTZ	82.3
CHALCEDONY	52.4
NAK	148.7

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.348 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-17.808	99.999	ALBITE LOW	-17.002	99.999
ANHYDRITE	-5.371	-7.340	CALCITE	-9.069	-10.188
MG-CHLORITE	-80.557	99.999	FLUORITE	-10.568	-11.712
LAUMONDITE	-27.840	99.999	MICROCLINE	-19.310	99.999
CA-MONTHOR.	-88.766	99.999	K-MONTHOR.	-43.742	99.999
NA-MONTHOR.	-43.394	99.999	MUSCOVITE	-22.016	99.999
PYRRHOTITE	1.392	99.999	PYRITE	-45.307	99.999
WAIRAKITE	-24.980	99.999	WOLLASTONITE	10.807	7.757
EPIDOTE	-141.675	99.999			
			ANALCINE	-13.519	99.999
			CHALCEDONY	-2.990	-3.272
			GOETHITE	-6.671	99.999
			MAGNETITE	-29.299	99.999
			MG-MONTHOR.	-89.729	99.999
			PREHNITE	-37.237	99.999
			QUARTZ	-3.246	-3.272
			ZOISITE	-36.244	99.999

ORKUSTOFNUM JHD
1980-11-14 HQRDUR

MADAGASCAR

8004050068

SOURCE DE MAFANA, FIANARANTSOA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	8.20/18.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
SI02	50.40	CO2			
NA	82.20	H2S	SAMPLING PRESSURE	BARS ABS.	
K	3.70	H2	DISCHARGE ENTHALPY	MJ/OL/KG	
CA	69.70	O2	DISCHARGE	KG/SEC.	1.0
MG	0.180	CH4			
CO2	32.00	N2	MEASURED TEMPERATURE	DEGREES C	40.0
SO4	324.70		RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
H2S	0.17		EH/TEMP.	MV/DEG.C	0.000/ 0.0
CL	9.90				

F	3.66	LITERS GAS PER 'KG	MEASURED DOWNHOLE TEMP.	FLUID INFLOW
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	DEGREES C/METERS	DEPTH (METERS)
AL	0.0000			
B	0.0600	CONDENSATE (PPM)		
FE	0.0000	PH/DEG.C		
NH3	0.0000	CO2		
*		H2S		
*		NA		
*				
		CONDENSATE WITH NaOH (PPM)		
		CO2		
		H2S		

IONIC STRENGTH = 0.01183 IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.00672741
 ANIONS (MOL.EQ.) 0.00753074
 DIFFERENCE (%) -11.27

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	50.40	CO2	32.00	CO2	0.485E-02
NA	82.20	H2S	0.17	H2S	0.177E-04
K	3.70	H2	0.00	H2	0.000E+00
CA	69.70	O2	0.00	O2	0.000E+00
MG	0.180	CH4	0.00	CH4	0.000E+00
SO4	324.69	N2	0.00	N2	0.000E+00
CL	9.90	NH3	0.00	NH3	0.000E+00
F	3.66			H2O	0.107E+01
DISS.S.	0.00			TOTAL	0.108E+01
AL	0.0000				
B	0.0600			H2O (%)	0.00
FE	0.0000			BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.896	KSO4-	0.886	FE++	0.623	FECL+	0.881
OH-	0.879	F-	0.879	FE+++	0.376	AL+++	0.376
H3SI04-	0.881	CL-	0.878	FEOH+	0.884	ALOH+	0.617
H2SI04--	0.617	NA+	0.881	FE(OH)3-	0.884	AL(OH)2+	0.886
H2BO3-	0.876	K+	0.878	FE(OH)4--	0.614	AL(OH)4-	0.883
HCO3-	0.881	CA++	0.623	FEOH++	0.614	ALSO4+	0.883
CO3--	0.609	MG++	0.639	FE(OH)2+	0.886	AL(SO4)2-	0.883
HS-	0.879	CAHCO3+	0.888	FE(OH)4-	0.886	ALF++	0.617
S--	0.614	MGHCO3+	0.881	FESO4+	0.884	ALF2+	0.886
HSO4-	0.883	CAOH+	0.888	FECL++	0.614	ALF4-	0.883
SO4--	0.605	MGOH	0.889	FECL2+	0.884	ALF5--	0.609
NAO4-	0.886	NH4+	0.876	FECL4-	0.881	ALF6---	0.328

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.473	MG++	0.08	-5.503	FE(OH)3	0.00	0.000
OH-	0.34	-4.705	NACL	0.01	-6.760	FE(OH)4-	0.00	0.000
H4SI04	77.64	-3.093	KCL	0.00	-8.759	FECL+	0.00	0.000
H3SI04-	2.85	-4.523	NAO4-	3.24	-4.565	FECL2	0.00	0.000
H2SI04--	0.00	-7.880	KSO4-	0.44	-5.488	FECL++	0.00	0.000
NAH3SI04-	0.12	-5.983	CASO4	60.50	-3.352	FECL2+	0.00	0.000
H3BO3	0.33	-5.272	MGSO4	0.51	-5.376	FECL3	0.00	0.000
H2BO3-	0.01	-6.679	CACO3	0.95	-5.021	FECL4-	0.00	0.000
H2CO3	2.97	-4.320	MGCO3	0.00	-8.140	FESO4	0.00	0.000
HCO3-	38.25	-3.203	CAHCO3+	4.14	-4.388	FESO4+	0.00	0.000
CO3--	0.12	-5.704	MGHCO3+	0.00	-7.567	AL+++	0.00	0.000
H2S	0.02	-6.292	CAOH+	0.03	-6.233	ALOH+	0.00	0.000
HS-	0.15	-5.349	MGOH	0.00	-7.809	AL(OH)2+	0.00	0.000
S--	0.00	-13.782	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-16.596	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.01	-7.164	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	278.67	-2.537	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.391	FEOH	0.00	0.000	ALF++	0.00	0.000
F-	3.66	-3.715	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	9.89	-3.554	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	81.55	-2.450	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	3.57	-4.039	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	49.84	-2.905	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01072 IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.00617344
 ANIONS (MOL.EQ.) 0.00695883
 DIFFERENCE (%) -11.96

CHEMICAL EQUILIBRIUM CONSTANTS DEGREES C

QUARTZ	100.6
CHALCEDONY	70.6
NAK	124.9

1000/T DEGREES KELVIN = 2.67

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.370 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

TEOR.	CALC.	TEOR.	CALC.
ADULAKIA	-16.922	ALBITE LUM	-16.188
ANNHYDRITE	-5.629	CALCITE	-9.351
MG-CHLORITE	-7.731	FLUORITE	-10.538
LAURUMITE	-26.669	MICROCLINE	-10.295
CA-MONIMUR.	-82.545	K-MONIMUR.	-40.431
NA-MONIMUR.	-40.174	MUSCOVITE	-20.549
PTKIMITE	1.245	PYRITE	-42.920
MAIKANITE	-24.225	MULLASTURITE	10.236
EPIDOTE	-140.226		
		ANALCIME	-12.863
		CHALCEDONY	-2.843
		GUENITE	-5.913
		MAGNETITE	-27.892
		MG-MONIMUR.	-83.510
		PREHNITE	-36.338
		QUARTZ	-3.060
		ZOISITE	-35.410

UKKUSIUM-NUM JHD
1980-11-14 MUKDOK

MADAGASCAR

8004070072

SOURCE D'ANTSIKA, JULIANY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	8.59/28.0
SI02	106.90
NA	625.10
K	44.80
CA	111.50
MG	0.900
CO2	35.90
SO4	204.00
H2S	0.20
CL	1169.20
F	6.36
DISS.SOLIDS	0.00
AL	0.0000
B	2.1300
FE	0.0000
NH3	0.0000
*	
*	
*	

GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (WZ)
CO2			
H2S	SAMPLING PRESSURE	BARS ABS.	
H2	DISCHARGE ENTHALPY	MJUL/KG	
O2	DISCHARGE	KG/SEL.	2.5
CH4			
N2	MEASURED TEMPERATURE	DEGREES C	31.0
	RESISTIVITY/TEMP.	UMM/DEG.C	0.0/ 0.0
	EH/TEMP.	MV/DEG.C	0.000/ 0.0

LITERS GAS PER 'KG CONDENSATE/DEG.C	MEASURED DOWNHOLE TEMP. DEGREES C/METERS	FLUID INFLUX DEPTH (METERS)
CONDENSATE (PPM)	0.0	0.0
PH/DEG.C	0.0	0.0
CO2	0.0	0.0
H2S	0.0	0.0
NA	0.0	0.0
	0.0	0.0
	0.0	0.0
	0.0	0.0
	0.0	0.0
	0.0	0.0
CONDENSATE WITH NAOH (PPM)	0.0	0.0
CO2	0.0	0.0
H2S	0.0	0.0

IONIC STRENGTH = 0.04045

IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.03354659
 ANIONS (MOL.EQ.) 0.03813150
 DIFFERENCE (%) -12.79

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	106.91	CO2	35.90	CO2	0.00	CO2	0.732E-02
NA	625.10	H2S	0.20	H2S	0.00	H2S	0.215E-04
K	44.80	H2	0.00	H2	0.00	H2	0.000E+00
CA	111.50	O2	0.00	O2	0.00	O2	0.000E+00
MG	0.900	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	204.00	N2	0.00	N2	0.00	N2	0.000E+00
CL	1169.10	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	6.36			H2O	0.331E+01		
DISS.S.	0.00			TOTAL	0.331E+01		
AL	0.0000						
B	2.1298			H2O (Z)	0.00		
FE	0.0000			BOILING PORTION	0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.826	KSO4-	0.798	FE++	0.422	FECL+	0.785
OH-	0.780	F-	0.780	FE+++	0.185	AL+++	0.185
H3SI04-	0.785	CL-	0.775	FEOH+	0.795	ALOH++	0.412
H2SI04--	0.412	NA+	0.785	FE(OH)3-	0.795	AL(OH)2+	0.798
H2BO3-	0.769	K+	0.775	FE(OH)4--	0.404	AL(OH)4-	0.790
HCO3-	0.785	CA++	0.422	FEOH++	0.404	ALSO4+	0.790
CO3--	0.395	MG++	0.456	FE(OH)2+	0.798	AL(SO4)2-	0.790
HS-	0.780	CAHCO3+	0.804	FE(OH)4-	0.798	ALF++	0.412
S--	0.404	MGHCO3+	0.785	FESO4+	0.795	ALF2+	0.798
HSO4-	0.790	CAOH+	0.804	FECL++	0.404	ALF4-	0.790
SO4--	0.385	MGOH	0.808	FECL2+	0.795	ALF5--	0.395
NASO4-	0.798	NH4+	0.769	FECL4-	0.785	ALF6---	0.124

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.534	MG++	0.53	-4.664	FE(OH)3	0.00	0.000
OH-	1.26	-4.129	NACL	12.46	-3.671	FE(OH)4-	0.00	0.000
H4SI04	157.73	-2.785	KCL	0.25	-5.478	FECL+	0.00	0.000
H3SI04-	10.81	-3.944	NASO4-	13.32	-3.951	FECL2	0.00	0.000
H2SI04--	0.01	-7.058	KSO4-	3.05	-4.646	FECL++	0.00	0.000
NAH3SI04-	2.88	-4.612	CASO4	50.41	-3.431	FECL2+	0.00	0.000
H3BO3	11.55	-3.729	MGSO4	1.76	-4.834	FECL3	0.00	0.000
H2BO3-	0.62	-4.993	CACO3	2.66	-4.576	FECL4-	0.00	0.000
H2CO3	3.51	-4.247	MGCO3	0.00	-7.270	FESO4	0.00	0.000
HCO3-	37.66	-3.210	CAHCO3+	11.41	-3.947	FESO4+	0.00	0.000
CO3--	0.14	-5.635	MGHCO3+	0.02	-6.736	AL+++	0.00	0.000
H2S	0.02	-6.298	CAOH+	0.24	-5.376	ALOH++	0.00	0.000
HS-	0.18	-5.270	MGH+	0.02	-6.344	AL(OH)2+	0.00	0.000
S--	0.00	-13.174	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-16.298	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.01	-7.119	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	154.09	-2.795	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-6.917	FEOH+	0.00	0.000	ALF++	0.00	0.000
F-	6.36	-3.475	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	1161.42	-1.485	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	617.06	-1.571	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	43.78	-2.951	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	90.90	-2.644	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.03879

IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.03265741
 ANIONS (MOL.EQ.) 0.03713055
 DIFFERENCE (%) -12.82

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.44

QUARTZ	136.6
CHALCEDONY	107.2
NAK	164.4

OXIDATION POTENTIAL (VOLTS) :
 EH H2S = -0.443 EH CH4 = 99.999 EH H2 = 99.999 EH NH3 = 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

ADULARIA	TEUR.	CALC.	ALBITE LOW	TEUR.	CALC.	ANALCIME	TEOR.	CALC.
ANHYDRITE	-15.432	99.999	CALCITE	-14.805	99.999	CHALCEDONY	-11.754	99.999
MG-CHLORITE	-6.158	-6.228	FLUORITE	-9.972	-9.058	GUEHRITE	-2.604	-2.785
LAUNDRITE	-78.775	99.999	MICROLINE	-10.557	-10.185	MAGNETITE	-4.427	99.999
CA-MONIMUR.	-24.657	99.999	K-MONTHOR.	-16.598	99.999	MAGNETITE	-25.198	99.999
NA-MONIMUR.	-71.268	99.999	MUSCOVITE	-34.480	99.999	PSILONITE	-72.150	99.999
PYRRHOTITE	-34.362	99.999	PYRITE	-17.941	99.999	QUARTZ	-34.889	99.999
WAIKAKITE	1.036	99.999	WOLLASTONITE	-38.990	99.999	ZUISITE	-2.767	-2.785
EPIDOTE	-22.908	99.999		9.306	7.265		-33.971	99.999
	-138.726	99.999						

ORKUSTOFNUN JHD
1980-11-14 HORDUR

MADAGASCAR

8004270080

RANOHAFANA VOHITSARA, TOMASINA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

PH/DEG.C	9.28/28.0
SI02	75.00
NA	123.30
K	4.00
CA	8.20
MG	0.590
CO2	27.40
SO4	159.30
H2S	0.17
CL	73.00
F	4.40
DISS.SOLIDS	0.00
AL	0.0000
B	0.0500
FE	0.0000
NH3	0.0000
*	
*	
*	

STEAM SAMPLE

GAS (VOL.%)
CO2
H2S
H2
O2
CH4
N2

REFERENCE TEMP. DEGREES C 0.0 (OTZ)

SAMPLING PRESSURE BARS ABS.
DISCHARGE ENTHALPY MJ/OL/KG
DISCHARGE KG/SEC. 1.0

MEASURED TEMPERATURE DEGREES C 38.0
RESISTIVITY/TEMP. OHM/DEG.C 0.0/ 0.0
EH/TEMP. MV/DEG.C 0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C /

MEASURED DOWNHOLE TEMP. DEGREES C/METERS
FLUID INFLOW DEPTH (METERS)

CONDENSATE (PPM)	0.0	0.0	0.0
PH/DEG.C	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
NA	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0

CONDENSATE WITH NAOH (PPM)	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.00808

IONIC BALANCE : CATIONS (MOL.EQ.)0.00583832
ANIONS (MOL.EQ.)0.00653938
DIFFERENCE (%) -11.33

DEEP WATER (PPM)

SI02	75.01
NA	123.30
K	4.00
CA	8.20
MG	0.590
SO4	159.30
CL	72.99
F	4.40
DISS.S.	0.00
AL	0.0000
B	0.0500
FE	0.0000

DEEP STEAM (PPM)

CO2	27.40
H2S	0.17
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.339E-04
H2S	0.404E-06
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.702E-01
TOTAL	0.703E-01

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.918	KSO4-	0.911	FE++	0.694	FECL+	0.908
OH-	0.907	F-	0.907	FE+++	0.466	AL+++	0.466
H3SI04-	0.908	CL-	0.906	FE0H+	0.910	ALOH++	0.690
H2SI04--	0.690	NA+	0.908	FE(OH)3-	0.910	AL(OH)2+	0.911
H2BO3-	0.904	K+	0.906	FE(OH)4--	0.688	AL(OH)4-	0.909
HCO3-	0.908	CA++	0.694	FE0H++	0.688	ALSO4+	0.909
CO3--	0.684	MG++	0.706	FE(OH)2+	0.911	AL(SO4)2-	0.909
HS-	0.907	CAHCO3+	0.912	FE(OH)4-	0.911	ALF++	0.690
S--	0.688	MGHCO3+	0.908	FESO4+	0.910	ALF2+	0.911
H2SO4	0.909	CAOH+	0.912	FECL++	0.688	ALF4-	0.909
SO4--	0.681	MGOH+	0.913	FECL2+	0.910	ALF5--	0.684
NASO4-	0.911	NH4+	0.904	FECL4-	0.908	ALF6---	0.426

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-9.090	MG++	0.47	-4.713	FE(OH)3	0.00	0.000
OH-	0.64	-4.427	NACL	0.02	-6.446	FE(OH)4-	0.00	0.000
H4SI04	91.21	-3.023	KCL	0.00	-8.215	FECL+	0.00	0.000
H3SI04-	26.75	-3.551	NASO4-	1.42	-4.924	FECL2	0.00	0.000
H2SI04--	0.13	-5.851	KSO4-	0.13	-6.023	FECL++	0.00	0.000
NAH3SI04-	1.96	-4.780	CASO4	2.35	-4.763	FECL2+	0.00	0.000
H3BO3	0.15	-5.619	MGSO4	0.50	-5.384	FECL3	0.00	0.000
H2BO3-	0.13	-5.854	CAC03	0.84	-5.074	FECL4-	0.00	0.000
H2CO3	0.06	-6.043	MGC03	0.05	-6.258	FESO4	0.00	0.000
HCO3-	34.15	-3.252	CAHCO3+	0.11	-5.961	FESO4+	0.00	0.000
CO3--	3.11	-4.285	MGHCO3+	0.01	-7.003	AL+++	0.00	0.000
H2S	0.00	-7.537	CAOH+	0.01	-7.057	ALOH+	0.00	0.000
HS-	0.16	-5.305	MGOH+	0.00	-7.010	AL(OH)2+	0.00	0.000
S--	0.00	-12.943	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-21.696	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
H2SO4	0.00	-9.832	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	156.01	-2.789	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-9.475	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	4.40	-3.635	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	72.98	-2.686	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	122.64	-2.273	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	3.96	-3.994	FE(OH)4+	0.00	0.000	ALF5--	0.00	0.000
CA++	7.12	-3.750	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00806

IONIC BALANCE : CATIONS (MOL.EQ.)0.00583125
ANIONS (MOL.EQ.)0.00653049
DIFFERENCE (%) -11.31

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.28

QUARTZ	108.2
CHALCEDONY	78.3
NAK	103.1

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.370 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-20.239	99.999	ALBITE LOW	-19.216	99.999
ANHYDRITE	-4.849	-6.865	CALCITE	-8.551	-8.358
MG-CHLORITE	-83.617	99.999	FLUORITE	-10.799	-11.264
LAUNONDITE	-30.970	99.999	MICROCLINE	-22.108	99.999
CA-MONTHOR.	-104.104	99.999	K-MONTHOR.	-52.030	99.999
NA-MONTHOR.	-51.403	99.999	MUSCOVITE	-25.755	99.999
PYRRHOTITE	1.856	99.999	PYRITE	-51.853	99.999
WAIRAKITE	-26.992	99.999	WOLLASTONITE	12.416	11.248
EPIDOTE	-147.227	99.999			
			ANALCINE	-15.282	99.999
			CHALCEDONY	-3.396	-3.023
			GOETHITE	-8.432	99.999
			MAGNETITE	-32.639	99.999
			MG-MONTHOR.	-104.875	99.999
			PREHNITE	39.871	99.999
			QUARTZ	-3.782	-3.023
			ZOISITE	-38.533	99.999

ORKUSTOFNUN JHU
1980-11-21 HORDUR

MADAGASCAR

8005110083 RANOMAFANA - DOANY, ANTSIRANANA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

PH/DEG.C	7.62/23.0
SI02	64.10
NA	279.20
K	10.80
CA	19.10
MG	3.720
CO2	476.30
SO4	104.80
H2S	0.20
CL	46.50
F	6.50
DISS.SOLIDS	0.00
AL	0.0000
B	0.0800
FE	0.0000
NH3	0.0000
*	
*	
*	

STEAM SAMPLE

GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
CO2	SAMPLING PRESSURE	BARS ABS.	
H2S	DISCHARGE ENTHALPY	MJ/OL/KG	
H2	DISCHARGE	KG/SEC.	5.0
O2	MEASURED TEMPERATURE	DEGREES C	59.0
CH4	RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0
N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0

LITERS GAS PER 'KG
CONDENSATE/DEG.C

CONDENSATE (PPM)	0.0	0.0	0.0
PH/DEG.C	0.0	0.0	0.0
CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0
NA	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0

CONDENSATE WITH NaOH (PPM)

CO2	0.0	0.0	0.0
H2S	0.0	0.0	0.0

IONIC STRENGTH = 0.01543

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01355963
ANIONS (MOL.EQ.) 0.01402778
DIFFERENCE (%) -3.39

SIHCR > 2.0

DEEP WATER (PPM)

SI02	64.11
NA	279.20
K	10.80
CA	19.10
MG	3.720
SO4	104.80
CL	46.50
F	6.50
DISS.S.	0.00
AL	0.0000
B	0.0800
FE	0.0000

DEEP STEAM (PPM)

CO2	0.00
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.770E-01
H2S	0.184E-04
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.162E+01
TOTAL	0.169E+01

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.880	KSO4-	0.866	FE++	0.572	FECL+	0.860
OH-	0.858	F-	0.858	FE+++	0.319	AL+++	0.319
H3SI04-	0.860	CL-	0.855	FE0H+	0.864	ALOH++	0.565
H2SI04--	0.565	NA+	0.860	FE(OH)3-	0.864	AL(OH)2+	0.866
H2BO3-	0.853	K+	0.855	FE(OH)4--	0.561	AL(OH)4-	0.862
HCO3-	0.860	CA++	0.572	FE0H++	0.561	ALSO4+	0.862
CO3--	0.555	MG++	0.592	FE(OH)2+	0.866	AL(SO4)2-	0.862
HS-	0.858	CAHCO3+	0.869	FE(OH)4-	0.866	ALF++	0.565
S--	0.561	MGHCO3+	0.860	FESD4+	0.864	ALF2+	0.866
HSD4-	0.862	CAOH+	0.869	FECL++	0.561	ALF4-	0.862
SD4--	0.549	MGOH+	0.871	FECL2+	0.864	ALF5--	0.555
NASO4-	0.866	NH4+	0.853	FECL4-	0.860	ALF6---	0.266

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.559	MG++	2.21	-4.042	FE(OH)3	0.00	0.000
OH-	0.63	-4.433	NACL	0.19	-5.478	FE(OH)4-	0.00	0.000
H4SI04	96.67	-2.998	KCL	0.00	-7.557	FECL+	0.00	0.000
H3SI04-	5.22	-4.261	NASO4-	3.93	-4.481	FECL2	0.00	0.000
H2SI04--	0.00	-7.469	KSO4-	0.47	-5.455	FECL++	0.00	0.000
NAH3SI04-	0.73	-5.206	CASO4	4.17	-4.514	FECL2+	0.00	0.000
H3BO3	0.44	-5.152	MGSO4	5.33	-4.354	FECL3	0.00	0.000
H2BO3-	0.02	-6.447	CACD3	4.34	-4.363	FECL4-	0.00	0.000
H2CO3	42.53	-3.164	MGCC3	0.36	-5.373	FESD4	0.00	0.000
HCO3-	603.01	-2.005	CAHCO3+	15.81	-3.806	FESD4+	0.00	0.000
CO3--	2.28	-4.421	MGHCO3+	1.09	-4.893	AL+++	0.00	0.000
H2S	0.02	-6.313	CAOH+	0.01	-6.638	ALOH++	0.00	0.000
HS-	0.18	-5.269	MGOH+	0.04	-6.045	AL(OH)2+	0.00	0.000
S--	0.00	-13.465	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-16.979	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSD4-	0.00	-7.581	FE++	0.00	0.000	ALSO4+	0.00	0.000
SD4--	94.09	-3.009	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.122	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	6.50	-3.466	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	46.38	-2.883	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	278.22	-1.917	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	10.66	-3.564	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	9.86	-3.609	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01480

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.01321818
ANIONS (MOL.EQ.) 0.01366482
DIFFERENCE (%) -3.32

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	111.0
CHALCEDONY	81.2
NAK	114.9

1000/T DEGREES KELVIN = 2.59

OXIDATION POTENTIAL (VOLTS) :
EH H2S= -0.404 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.			
ADULARIA	-16.389	99.999	ALBITE LOW	-15.696	99.999	ANALCIME	-12.467	99.999
ANHYDRITE	-5.804	-7.121	CALCITE	-9.550	-8.529	CHALCEDONY	-2.756	-2.998
MG-CHLORITE	-79.324	99.999	FLUORITE	-10.535	-10.917	GOETHITE	-5.417	99.999
LAUMONDITE	-25.956	99.999	MICROCLINE	-17.686	99.999	MAGNETITE	-26.983	99.999
CA-MONTHOR.	-78.633	99.999	K-MONTHOR.	-38.358	99.999	MG-MONTHOR.	-79.578	99.999
NA-MONTHOR.	-38.154	99.999	MUSCOVITE	-19.638	99.999	PREHNITE	-35.810	99.999
PYRRHOTITE	1.165	99.999	PYRITE	-41.502	99.999	QUARTZ	-2.954	-2.998
WAIKAKITE	-23.758	99.999	WOLLASTONITE	9.899	8.269	ZOISITE	-34.900	99.999
EPIDOTE	-139.545	99.999						

ORKUSTOFNUM JHD
1980-11-14 HORDUR

MADAGASCAR

8005140089 RANDAFANA D'AMBODIANGEZOKA, ANTSIRANANA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE		REFERENCE TEMP.		DEGREES C		0.0 (QTZ)	
PH/DEG.C	7.61/24.0	GAS (VOL.%)							
SI02	102.60	CO2							
NA	328.30	H2S		SAMPLING PRESSURE	BARS ABS.				
K	20.90	H2		DISCHARGE ENTHALPY	KJGUL/KG				
CA	42.80	O2		DISCHARGE	KG/SEC.	10.0			
MG	4.300	CH4							
CO2	344.00	N2		MEASURED TEMPERATURE	DEGREES C	63.0			
SO4	322.60			RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0			
H2S	0.17			EH/TEMP.	MV/DEG.C	0.000/ 0.0			
CL	154.50								
F	4.60	LITERS GAS PER 'KG							
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	/	MEASURED DOWNHOLE TEMP.	DEGREES C/METERS			FLUID INFLOW	DEPTH (METERS)
AL	0.0000								
B	0.1800	CONDENSATE (PPM)				0.0	0.0	0.0	0.0
FE	0.0000	PH/DEG.C	/			0.0	0.0	0.0	0.0
NH3	0.0000	CO2				0.0	0.0	0.0	0.0
*		H2S				0.0	0.0	0.0	0.0
*		NA				0.0	0.0	0.0	0.0
*						0.0	0.0	0.0	0.0
		CONDENSATE WITH NAOH (PPM)				0.0	0.0	0.0	0.0
		CO2				0.0	0.0	0.0	0.0
		H2S				0.0	0.0	0.0	0.0

IONIC STRENGTH = 0.02191 IONIC BALANCE : CATIONS (MOL.EQ.)0.01693114
 ANIONS (MOL.EQ.)0.01836990
 DIFFERENCE (%) -8.15

SINCOR > 2.0

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	102.61	CO2	344.00	CO2	0.844E-01
NA	328.30	H2S	0.17	H2S	0.190E-04
K	20.90	H2	0.00	H2	0.000E+00
CA	42.80	O2	0.00	O2	0.000E+00
MG	4.300	CH4	0.00	CH4	0.000E+00
SO4	322.59	N2	0.00	N2	0.000E+00
CL	154.49	NH3	0.00	NH3	0.000E+00
F	4.60			H2O	0.346E+01
DISS.S.	0.00			TOTAL	0.354E+01
AL	0.0000				
B	0.1800	H2O (%)	0.00		
FE	0.0000	BOILING PORTION	0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.858	KS04-	0.839	FE++	0.508	FECL+	0.831
OH-	0.828	F-	0.828	FE+++	0.255	AL+++	0.255
H3SI04-	0.831	CL-	0.825	FEDH+	0.837	ALOH++	0.500
H2SI04--	0.500	NA+	0.831	FE(OH)3-	0.837	AL(OH)2+	0.837
H2BO3-	0.821	K+	0.825	FE(OH)4--	0.494	AL(OH)4-	0.834
HCO3-	0.831	CA++	0.508	FEDH++	0.494	ALSO4+	0.834
CO3--	0.487	MG++	0.533	FE(OH)2+	0.839	AL(SO4)2-	0.834
HS-	0.828	CAHCO3+	0.843	FE(OH)4-	0.839	ALF++	0.500
S--	0.494	MGHCO3+	0.831	FES04+	0.837	ALF2+	0.839
HSO4-	0.834	CAOH+	0.843	FECL++	0.494	ALF4-	0.834
SO4--	0.480	MGOH+	0.845	FECL2+	0.837	ALF5--	0.487
NASO4-	0.839	NH4+	0.821	FECL4-	0.831	ALF6---	0.179

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.549	MG++	1.44	-4.229	FE(OH)3	0.00	0.000
OH-	1.28	-4.124	NACL	1.00	-4.768	FE(OH)4-	0.00	0.000
H4SI04	152.40	-2.800	KCL	0.02	-6.632	FECL+	0.00	0.000
H3SI04-	10.29	-3.966	NASO4-	16.13	-3.868	FECL2	0.00	0.000
H2SI04--	0.01	-7.125	KS04-	3.23	-4.622	FECL++	0.00	0.000
NAH3SI04-	1.62	-4.862	CASO4	28.50	-3.679	FECL2+	0.00	0.000
H3BO3	0.98	-4.801	MGS04	12.96	-3.968	FECL3	0.00	0.000
H2BO3-	0.05	-6.079	CACO3	8.04	-4.095	FECL4-	0.00	0.000
H2CO3	40.23	-3.188	MGCO3	0.18	-5.682	FES04	0.00	0.000
HCO3-	411.36	-2.171	CAHCO3+	31.90	-3.501	FES04+	0.00	0.000
CO3--	1.32	-4.657	MGHCO3+	0.55	-5.187	AL+++	0.00	0.000
H2S	0.02	-6.355	CAOH+	0.06	-5.967	ALOH++	0.00	0.000
HS-	0.15	-5.342	MGOH+	0.06	-5.819	AL(OH)2+	0.00	0.000
S--	0.00	-13.280	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-15.939	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.02	-6.784	FE+	0.00	0.000	ALSO4+	0.00	0.000
SO4--	276.82	-2.540	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.031	FEDH+	0.00	0.000	ALF++	0.00	0.000
F-	4.60	-3.616	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	153.87	-2.362	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	324.48	-1.850	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	19.96	-3.292	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	18.50	-3.336	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.02008 IONIC BALANCE : CATIONS (MOL.EQ.)0.01599029
 ANIONS (MOL.EQ.)0.01732057
 DIFFERENCE (%) -7.99

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.43

QUARTZ	134.7
CHALCEDONY	105.2
NAK	152.1

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.443 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-15.371	99.999	ALBITE LOW	-14.749	99.999
AMHYDRITE	-6.182	-6.489	CALCITE	-10.002	-8.599
MG-CHLORITE	-78.749	99.999	FLUORITE	-10.559	-11.026
LAUMONDITE	-24.574	99.999	MICROCLINE	16.530	99.999
CA-MONTHOR.	-70.785	99.999	K-MONTHOR.	-34.227	99.999
NA-MONTHOR.	-34.113	99.999	MUSCOVITE	-17.832	99.999
PYRRHOTITE	1.029	99.999	PYRITE	-38.831	99.999
WAIKAKITE	-22.854	99.999	WOLLASTONITE	9.268	8.667
EPIDOTE	-138.693	99.999			
			ANALCINE	-11.767	99.999
			CHALCEDONY	-2.594	-2.800
			GOETHITE	-4.359	99.999
			MAGNETITE	-25.077	99.999
			MG-MONTHOR.	-71.662	99.999
			PREHNITE	-34.832	99.999
			QUARTZ	-2.758	-2.800
			ZOISITE	33.912	99.999

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

8005160091

RANOMAFANA DE MAROLAKANA, ANTSIRANANA, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	8.11/24.5	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (RTZ)
SI02	88.10	CO2			
NA	178.50	H2S	SAMPLING PRESSURE	BARS ABS.	
K	5.10	H2	DISCHARGE ENTHALPY	MJ/OL/KG	
CA	15.10	O2	DISCHARGE	KG/SEC.	10.0
MG	3.900	CH4			
CO2	335.40	N2	MEASURED TEMPERATURE	DEGREES C	52.0
SO4	68.50		RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0
H2S	0.00		EH/TEMP.	MV/DEG.C	0.000/ 0.0

CL	31.00	LITERS GAS PER 'KG	MEASURED DOWNHOLE TEMP.	FLUID INFLOW
F	3.50	CONDENSATE/DEG.C	DEGREES C/METERS	DEPTH (METERS)
DISS.SOLIDS	0.00			
AL	0.0000	CONDENSATE (PPM)		
B	0.0200	PH/DEG.C		
FE	0.0000	CO2	0.0	0.0
NH3	0.0000	H2S	0.0	0.0
H2S	<0.1	NA	0.0	0.0
*			0.0	0.0
*			0.0	0.0
		CONDENSATE WITH NAOH (PPM)		
		CO2	0.0	0.0
		H2S	0.0	0.0

IONIC STRENGTH = 0.01064

IONIC BALANCE : CATIONS (MOL.EQ.)0.00886745
ANIONS (MOL.EQ.)0.00997184
DIFFERENCE (%) -11.72

SIHCOR > 2.0

DEEP WATER (PPM)

SI02	88.11
NA	178.50
K	5.10
CA	15.10
MG	3.900
SO4	68.50
CL	31.00
F	3.50
DISS.S.	0.00
AL	0.0000
B	0.0200
FE	0.0000

DEEP STEAM (PPM)

CO2	335.40
H2S	0.00
H2	0.00
O2	0.00
CH4	0.00
N2	0.00
NH3	0.00

GAS PRESSURES (BARS ABS.)

CO2	0.458E-01
H2S	0.000E+00
H2	0.000E+00
O2	0.000E+00
CH4	0.000E+00
N2	0.000E+00
NH3	0.000E+00
H2O	0.266E+01
TOTAL	0.270E+01

H2O (%) 0.00
BOILING PORTION 0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.891	KSO4-	0.880	FE++	0.607	FECL+	0.875
OH-	0.873	F-	0.873	FE+++	0.356	AL+++	0.356
H3SI04-	0.875	CL-	0.872	FE0H+	0.879	AL0H++	0.602
H2SI04--	0.602	NA+	0.875	FE(OH)3-	0.879	AL(OH)2+	0.880
H2BO3-	0.870	K+	0.872	FE(OH)4--	0.598	AL(OH)4-	0.877
HCO3-	0.875	CA++	0.607	FE0H++	0.598	ALSO4+	0.877
CO3--	0.593	MG++	0.624	FE(OH)2+	0.880	AL(SO4)2-	0.877
HS-	0.873	CAHCO3+	0.882	FE(OH)4-	0.880	ALF++	0.602
S--	0.598	MGHCO3+	0.875	FES04+	0.879	ALF2+	0.880
HSO4-	0.877	CAOH+	0.882	FECL+	0.598	ALF4-	0.877
SO4--	0.589	MGOH+	0.883	FECL2+	0.879	ALF5--	0.593
NASO4-	0.880	NH4+	0.870	FECL4-	0.875	ALF6---	0.309

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.777	MG++	2.28	-4.027	FE(OH)3	0.00	0.000
OH-	1.62	-4.021	NACL	0.11	-5.728	FE(OH)4-	0.00	0.000
H4SI04	126.83	-2.880	KCL	0.00	-7.938	FECL+	0.00	0.000
H3SI04-	12.96	-3.866	NASO4-	2.11	-4.751	FECL2	0.00	0.000
H2SI04--	0.01	-6.855	KSO4-	0.19	-5.845	FECL++	0.00	0.000
NAH3SI04-	1.23	-4.984	CASO4	2.92	-4.669	FECL2+	0.00	0.000
H3BO3	0.11	-5.768	MGSO4	5.44	-4.345	FECL3	0.00	0.000
H2BO3-	0.01	-6.844	CACD3	5.61	-4.251	FECL4-	0.00	0.000
H2CO3	22.84	-3.434	MGCO3	0.55	-5.182	FES04	0.00	0.000
HCO3-	428.30	-2.154	CAHCO3+	12.40	-3.911	FES04+	0.00	0.000
CO3--	2.22	-4.432	MGHCO3+	0.98	-4.939	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.03	-6.255	AL0H++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.13	-5.500	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.188	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-7.740	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	60.26	-3.203	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.445	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	3.50	-3.735	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	30.93	-3.059	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	177.81	-2.112	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	5.04	-3.889	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	7.05	-3.754	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01002

IONIC BALANCE : CATIONS (MOL.EQ.)0.00854111
ANIONS (MOL.EQ.)0.00963622
DIFFERENCE (%) -12.05

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.48

QUARTZ	124.8
CHALCEDONY	95.1
NAK	94.3

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ABULARIA	-15.728	99.999	ALBITE LOW	-15.082	99.999	ANALCIME	-11.975	99.999
ANHYDRITE	-6.042	-7.404	CALCITE	-9.832	-8.630	CHALCEDONY	-2.650	-2.880
MG-CHLORITE	-78.919	99.999	FLUORITE	-10.546	-11.558	GOETHITE	-4.749	99.999
LAUMONDITE	-25.062	99.999	MICROCLINE	-16.935	99.999	MAGNETITE	-25.775	99.999
CA-MONTHOR.	-73.594	99.999	K-MONTHOR.	-35.703	99.999	MG-MONTHOR.	-74.500	99.999
NA-MONTHOR.	-35.560	99.999	MUSCOVITE	-18.476	99.999	PREHNITE	-35.170	99.999
PYRRHOTITE	1.074	99.999	PYRITE	-39.764	99.999	QUARTZ	-2.825	-2.880
WAIKAKITE	-23.173	99.999	WOLLASTONITE	9.488	8.703	ZOISITE	-34.261	99.999
EPIDOTE	-138.920	99.999						

ORKUSTOFNUN JHD
1980-11-14 HORDUR

MADAGASCAR

8005070093

SOURCE DE SOATANIMBARY, TOLIARY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	7.84/27.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
SI02	55.30	CO2			
NA	242.90	H2S	SAMPLING PRESSURE	BARS ABS.	
K	7.50	H2	DISCHARGE ENTHALPY	MJ/OL/KG	
CA	6.70	O2	DISCHARGE	KG/SEC.	2.0
MG	0.160	CH4			
CO2	93.70	N2	MEASURED TEMPERATURE	DEGREES C	45.0
SO4	67.50		RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
H2S	0.00		EH/TEMP.	MV/DEG.C	0.000/ 0.0
CL	296.50				
F	13.10	LITERS GAS PER 'KG	MEASURED DOWNHOLE TEMP.	DEGREES C/METERS	FLUID INFLOW
DISS.SOLIDS	0.00	CONDENSATE/DEG.C			DEPTH (METERS)
AL	0.0000				
B	0.1900	CONDENSATE (PPM)			
FE	0.0000	PH/DEG.C			
NH3	0.0000	CO2			
H2S	<0.1	H2S			
*		NA			
*					
		CONDENSATE WITH NAOH (PPM)			
		CO2			
		H2S			

IONIC STRENGTH = 0.01266

IONIC BALANCE :

CATIONS (MOL.EQ.)	0.01107838
ANIONS (MOL.EQ.)	0.01251105
DIFFERENCE (%)	-12.15

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	55.30	CO2	93.70	CO2	0.00	CO2	0.136E-01
NA	242.90	H2S	0.00	H2S	0.00	H2S	0.000E+00
K	7.50	H2	0.00	H2	0.00	H2	0.000E+00
CA	6.70	O2	0.00	O2	0.00	O2	0.000E+00
MG	0.160	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	67.50	N2	0.00	N2	0.00	N2	0.000E+00
CL	296.47	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	13.10					H2O	0.126E+01
DISS.S.	0.00					TOTAL	0.127E+01
AL	0.0000						
B	0.1900					H2O (%)	0.00
FE	0.0000					BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.889	KS04-	0.877	FE++	0.599	FECL+	0.872
OH-	0.870	F-	0.870	FE+++	0.349	AL+++	0.349
H3SI04-	0.872	CL-	0.867	FE0H+	0.875	AL0H++	0.593
H2SI04--	0.593	NA+	0.872	FE(OH)3-	0.375	AL(OH)2+	0.877
H2B03-	0.865	K+	0.867	FE(OH)4--	0.589	AL(OH)4-	0.873
HCO3-	0.872	CA++	0.599	FE0H++	0.589	ALSO4+	0.873
CO3--	0.584	MG++	0.618	FE(OH)2+	0.877	AL(SO4)2-	0.873
HS-	0.870	CAHCO3+	0.879	FE(OH)4-	0.877	ALF++	0.593
S--	0.589	MGHCO3+	0.872	FES04+	0.875	ALF2+	0.877
HSO4-	0.873	CAOH+	0.879	FECL++	0.589	ALF4-	0.873
SO4--	0.579	MGOH+	0.881	FECL2+	0.875	ALF5--	0.584
MAS04-	0.877	NH4+	0.865	FECL4-	0.872	ALF6---	0.299

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.556	MG++	0.12	-5.315	FE(OH)3	0.00	0.000
OH-	0.48	-4.548	NACL	0.97	-4.781	FE(OH)4-	0.00	0.000
H4SI04	83.97	-3.059	KCL	0.01	-6.945	FECL+	0.00	0.000
H3SI04-	4.03	-4.372	MAS04-	2.25	-4.724	FECL2	0.00	0.000
H2SI04--	0.00	-7.619	KS04-	0.22	-5.798	FECL++	0.00	0.000
NAH3SI04-	0.51	-5.369	CAS04	1.53	-4.949	FECL2+	0.00	0.000
H3B03	1.04	-4.776	MGS04	0.18	-5.816	FECL3	0.00	0.000
H2B03-	0.05	-6.088	CACO3	0.42	-5.372	FECL4-	0.00	0.000
H2CO3	7.99	-3.890	MGCO3	0.00	-7.365	FES04	0.00	0.000
HCO3-	120.39	-2.705	CAHCO3+	1.54	-4.818	FES04+	0.00	0.000
CO3--	0.46	-5.120	MGHCO3+	0.01	-6.877	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.01	-7.028	ALOH++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-7.455	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-17.300	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-7.832	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	64.30	-3.174	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-6.881	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	13.10	-3.162	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	295.88	-2.078	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	241.99	-1.978	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	7.43	-3.721	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	5.47	-3.865	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.01254

IONIC BALANCE :

CATIONS (MOL.EQ.)	0.01101376
ANIONS (MOL.EQ.)	0.01243453
DIFFERENCE (%)	-12.12

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.64

QUARTZ	104.2
CHALCEDONY	74.3
NAK	99.6

OXIDATION POTENTIAL (VOLTS) :

EH H2S=	99.999	EH CH4=	99.999	EH H2=	99.999	EH NH3=	99.999
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LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-16.715	99.999	ALBITE LOW	-15.997	99.999	ANALCIME	-12.769	99.999
ANHYDRITE	-5.695	-7.499	CALCITE	7.426	-9.441	CHALCEDONY	-2.809	-3.059
MG-CHLORITE	-79.564	99.999	FLUORITE	-10.535	-10.532	GOETHITE	-5.725	99.999
LAUNONDITE	-26.393	99.999	MICROCLINE	-18.058	99.999	MAGNETITE	-27.545	99.999
CA-MONTHOR.	-81.043	99.999	K-MONTHOR.	-39.634	99.999	MG-MONTHOR.	-82.002	99.999
NA-MONTHOR.	-39.397	99.999	MUSCOVITE	-20.198	99.999	PREHNITE	-36.131	99.999
PYRRHOTITE	1.213	99.999	PYRITE	-42.367	99.999	QUARTZ	-3.019	-3.059
WAIKAKITE	-24.043	99.999	WOLLASTONITE	10.104	7.965	ZOISITE	-35.212	99.999
EPIDOTE	-139.944	99.999						

ORKUSTOFMUN JHD
1980-11-14 HORDUR

MADAGASCAR

8005090094 SOURCE DE MAHABO, TOLIARY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	7.45/24.0	GAS (VOL.%)	REFERENCE TEMP,	DEGREES C	0.0 (QTZ)
SI02	19.10	CO2			
NA	14.70	H2S	SAMPLING PRESSURE	BARS ABS.	
K	13.70	H2	DISCHARGE ENTHALPY	KJ/OL/KG	
CA	17.60	O2	DISCHARGE	KG/SEC.	8.0
MG	6.300	CH4			
CO2	179.80	N2	MEASURED TEMPERATURE	DEGREES C	37.0
SO4	17.10		RESISTIVITY/TEMP,	OHM/DEG.C	0.0/ 0.0
H2S	0.00		EH/TEMP,	MV/DEG.C	0.000/ 0.0
CL	11.10				
F	0.27				

DISS.SOLIDS	0.00	LITERS GAS PER 'KG	CONDENSATE/DEG.C	/	MEASURED DOWNHOLE TEMP,	FLUID INFLOW
AL	0.0000				DEGREES C/METERS	DEPTH (METERS)
B	0.0600					
FE	0.0000	CONDENSATE (PPM)				
NH3	0.0000	PH/DEG.C				
H2S	<0.1	CO2	0.0	0.0	0.0	
*		H2S	0.0	0.0	0.0	
*		NA	0.0	0.0	0.0	
			0.0	0.0	0.0	
			0.0	0.0	0.0	
		CONDENSATE WITH NaOH (PPM)	0.0	0.0	0.0	
		CO2	0.0	0.0	0.0	
		H2S	0.0	0.0	0.0	

IONIC STRENGTH = 0.00423 IONIC BALANCE : CATIONS (MOL.EQ.)0.00234265
ANIONS (MOL.EQ.)0.00442707
DIFFERENCE (%) -61.58

DEEP WATER (PPM)	DEEP STEAM (PPM)	GAS PRESSURES (BARS ABS.)
SI02 19.10	CO2 179.80	CO2 0.190E-01
NA 14.70	H2S 0.00	H2S 0.000E+00
K 13.70	H2 0.00	H2 0.000E+00
CA 17.60	O2 0.00	O2 0.000E+00
MG 6.299	CH4 0.00	CH4 0.000E+00
SO4 17.10	N2 0.00	N2 0.000E+00
CL 11.10	NH3 0.00	NH3 0.000E+00
F 0.27		H2O 0.215E+00
DISS.S. 0.00		TOTAL 0.234E+00
AL 0.0000		
B 0.0600	H2O (%) 0.00	
FE 0.0000	BOILING PORTION 0.00	

ACTIVITY COEFFICIENTS IN DEEP WATER

HH	0.935	KS04-	0.930	FE++	0.752	FECL+	0.928
OH-	0.928	F-	0.928	FE+++	0.546	AL+++	0.546
H3SI04-	0.928	CL-	0.927	FE0H+	0.930	AL0H+	0.750
H2SI04--	0.750	NA+	0.928	FE(OH)3-	0.930	AL(OH)2+	0.930
H2B03-	0.926	K+	0.927	FE(OH)4--	0.748	AL(OH)4--	0.929
HCO3-	0.928	CA++	0.752	FE0H++	0.748	ALSO4+	0.929
CO3--	0.746	MG++	0.760	FE(OH)2+	0.930	AL(SO4)2-	0.929
HS-	0.928	CAHCO3+	0.931	FE(OH)4-	0.930	ALF++	0.750
S--	0.748	MGHCO3+	0.928	FES04+	0.930	ALF2+	0.930
HSO4-	0.929	CAOH+	0.931	FECL+	0.748	ALF4-	0.929
SO4--	0.744	MGOH+	0.932	FECL2+	0.930	ALF5--	0.746
NAS04-	0.930	NH4+	0.926	FECL4-	0.928	ALF6---	0.518

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

HH (ACT.)	0.00	-7.352	MG++	5.76	-3.626	FE(OH)3	0.00	0.000
OH-	0.04	-5.601	NACL	0.00	-7.864	FE(OH)4	0.00	0.000
H4SI04	30.21	-3.503	KCL	0.00	-8.333	FECL+	0.00	0.000
H3SI04-	0.34	-5.453	NAS04-	0.02	-6.689	FECL2	0.00	0.000
H2SI04--	0.00	-9.251	KS04-	0.07	-6.309	FECL++	0.00	0.000
NAH3SI04-	0.00	-7.602	CAS04	0.83	-5.214	FECL2+	0.00	0.000
H3B03	0.34	-5.265	MGS04	1.25	-4.982	FECL3	0.00	0.000
H2B03-	0.01	-6.930	CAC03	0.56	-5.255	FECL4-	0.00	0.000
H2CO3	19.74	-3.497	MGC03	0.13	-5.812	FES04	0.00	0.000
HCO3-	226.34	-2.431	CAHCO3+	3.35	-4.480	FCS04+	0.00	0.000
CO3--	0.44	-5.130	MGHCO3+	0.88	-4.989	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-7.744	ALOH+	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-6.947	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-18.561	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.778	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	15.44	-3.794	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.746	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.27	-4.847	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	11.10	-3.504	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	14.69	-3.194	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	13.68	-3.456	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	15.80	-3.404	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00414 IONIC BALANCE : CATIONS (MOL.EQ.)0.00229478
ANIONS (MOL.EQ.)0.00437908
DIFFERENCE (%) -62.46

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.99

QUARTZ 61.4
CHALCEDONY 31.6
NAK 401.0

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-18.906	99.999	ALBITE LOW	-18.005	99.999	ANALCINE	-14.324	99.999
ANHYDRITE	-5.103	-7.450	CALCITE	-8.792	-8.785	CHALCEDONY	-3.174	-3.503
MG-CHLORITE	-81.815	99.999	FLUORITE	-10.647	-13.288	GOETHITE	-7.516	99.999
LAUMONDITE	-29.266	99.999	MICROCLINE	-20.574	99.999	MAGNETITE	-30.892	99.999
CA-MONTHOR.	-95.979	99.999	K-MONTHOR.	-47.619	99.999	MG-MONTHOR.	-96.885	99.999
NA-MONTHOR.	-47.149	99.999	MUSCOVITE	-23.751	99.999	PREHNITE	-38.352	99.999
PYRRHOTITE	1.593	99.999	PYRITE	-48.290	99.999	QUARTZ	-3.485	-3.503
WAIRAKITE	-25.896	99.999	WOLLASTONITE	11.530	7.673	ZOISITE	-37.264	99.999
EPIDOTE	-143.944	99.999						

ORKUSTOFNUM JHD
1980-11-14 HARDUR

MADAGASCAR

8005110096 SOURCE D'AMBANGO, TOLIARY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)		STEAM SAMPLE		REFERENCE TEMP.		DEGREES C		0.0 (QTZ)	
PH/DEG.C	8.39/23.0	GAS (VOL.%)							
SI02	16.20	CO2							
NA	175.10	H2S		SAMPLING PRESSURE	BARS ABS.				
K	1.44	H2		DISCHARGE ENTHALPY	KJOUL/KG				
CA	1.65	O2		DISCHARGE	KG/SEC.	2.0			
HG	0.130	CH4							
CO2	204.00	N2		MEASURED TEMPERATURE	DEGREES C	42.0			
SO4	106.80			RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0			
H2S	0.00			EH/TEMP.	MV/DEG.C	0.000/ 0.0			
CL	32.50								
F	0.80	LITERS GAS PER 'KG							
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	/	MEASURED DOWNHOLE TEMP.	DEGREES C/METERS			FLUID INFLOW	DEPTH (METERS)
AL	0.0000								
B	0.1600	CONDENSATE (PPM)				0.0	0.0	0.0	
FE	0.0000	PH/DEG.C	/			0.0	0.0	0.0	
NH3	0.0000	CO2				0.0	0.0	0.0	
H2S	<0.1	H2S				0.0	0.0	0.0	
*		NA				0.0	0.0	0.0	
*						0.0	0.0	0.0	
		CONDENSATE WITH NAOH (PPM)				0.0	0.0	0.0	
		CO2				0.0	0.0	0.0	
		H2S				0.0	0.0	0.0	

IONIC STRENGTH = 0.00898 IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.00772672
 ANIONS (MOL.EQ.) 0.00782487
 DIFFERENCE (%) -1.26

DEEP WATER (PPM)		DEEP STEAM (PPM)		GAS PRESSURES (BARS ABS.)	
SI02	16.20	CO2	204.00	CO2	0.302E-02
NA	175.10	H2S	0.00	H2S	0.000E+00
K	1.44	H2	0.00	H2	0.000E+00
CA	1.65	O2	0.00	O2	0.000E+00
HG	0.130	CH4	0.00	CH4	0.000E+00
SO4	106.80	N2	0.00	N2	0.000E+00
CL	32.50	NH3	0.00	NH3	0.000E+00
F	0.80			H2O	0.156E+00
DISS.S.	0.00			TOTAL	0.159E+00
AL	0.0000				
B	0.1600	H2O (%)	0.00		
FE	0.0000	BOILING PORTION	0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.913	KSO4-	0.905	FE++	0.676	FECL+	0.901
OH-	0.900	F-	0.900	FE+++	0.442	AL+++	0.442
H3SI04-	0.901	CL-	0.898	FE0H+	0.904	AL0H++	0.671
H2SI04--	0.671	NA+	0.901	FE(OH)3-	0.904	AL(OH)2+	0.905
H2BO3-	0.897	K+	0.898	FE(OH)4--	0.669	AL(OH)4-	0.902
HCO3-	0.901	CA++	0.676	FE0H++	0.669	ALSO4+	0.902
CO3--	0.665	MG++	0.689	FE(OH)2+	0.905	AL(SO4)2-	0.902
HS-	0.900	CAHCO3+	0.906	FE(OH)4-	0.905	ALF++	0.671
S--	0.669	MGHCO3+	0.901	FES04+	0.904	ALF2+	0.905
HSD4-	0.902	CAOH+	0.906	FECL++	0.669	ALF4-	0.902
SO4--	0.661	MGOH+	0.907	FECL2+	0.904	ALF5--	0.665
NASO4-	0.905	NH4+	0.897	FECL4-	0.901	ALF6---	0.400

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-8.166	MG++	0.10	-5.382	FE(OH)3	0.00	0.000
OH-	0.20	-4.936	NACL	0.02	-6.442	FE(OH)4-	0.00	0.000
H4SI04	24.31	-3.597	KCL	0.00	-8.918	FECL+	0.00	0.000
H3SI04-	1.47	-4.810	NASO4-	1.60	-4.870	FECL2	0.00	0.000
H2SI04--	0.00	-7.830	KSO4-	0.04	-6.553	FECL++	0.00	0.000
NAH3SI04-	0.15	-5.906	CASO4	0.35	-5.593	FECL2+	0.00	0.000
H3BO3	0.81	-4.885	MGSO4	0.10	-6.074	FECL3	0.00	0.000
H2BO3-	0.11	-5.753	CACO3	0.26	-5.586	FECL4-	0.00	0.000
H2CO3	3.58	-4.239	MGCO3	0.01	-6.791	FES04	0.00	0.000
HCO3-	275.28	-2.346	CAHCO3+	0.26	-5.597	FES04+	0.00	0.000
CO3--	3.65	-4.216	MGHCO3+	0.02	-6.726	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.00	-8.231	ALOH++	0.00	0.000
HS-	0.00	0.000	MGOH+	0.00	-8.117	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-19.597	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSD4-	0.00	-8.889	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	105.15	-2.961	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-9.163	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.80	-4.376	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	32.48	-3.038	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	174.75	-2.119	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	1.43	-4.437	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	1.34	-4.475	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00896 IONIC BALANCE :
 CATIONS (MOL.EQ.) 0.00771582
 ANIONS (MOL.EQ.) 0.00780963
 DIFFERENCE (%) -1.21

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 3.05

QUARTZ	53.5
CHALCEDONY	23.8
NAK	27.8

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

TEOR.		CALC.		TEOR.		CALC.	
ADULARIA	-19.295	99.999	ALBITE LOW	-18.358	99.999	ANALCIME	-14.605
ANHYDRITE	-5.021	-7.786	CALCITE	-8.712	-9.038	CHALCEDONY	-3.239
MG-CHLORITE	-82.314	99.999	FLUORITE	-10.685	-13.488	GOETHITE	-7.794
LAUMONDITE	-29.765	99.999	MICROCLINE	-21.021	99.999	MAGNETITE	-31.421
CA-MONTHOR.	-98.410	99.999	K-MONTHOR.	-48.935	99.999	HG-MONTHOR.	-99.283
NA-MONTHOR.	-48.420	99.999	MUSCOVITE	-24.346	99.999	PREHNITE	-38.813
PYRRHOTITE	1.668	99.999	PYRITE	-49.340	99.999	QUARTZ	-3.572
WAIRAKITE	-26.216	99.999	WOLLASTONITE	11.788	8.089	ZOISITE	-37.627
EPIDOTE	-144.850	99.999					

ORKUSTOFNUM JHD
1980-11-21 HORDUR

MADAGASCAR

8005190099 RANOMAFANA MAROSOVVA, TULEAR, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	9.40/21.0	GAS (VOL.Z)	REFERENCE TEMP,	DEGREES C	0.0 (QTZ)
SI02	89.00	CO2	SAMPLING PRESSURE	BARS ABS.	
NA	69.50	H2S	DISCHARGE ENTHALPY	MJOUL/KG	
K	1.04	H2	DISCHARGE	KG/SEC.	3.0
CA	1.07	O2	MEASURED TEMPERATURE	DEGREES C	51.0
MG	0.040	CH4	RESISTIVITY/TEMP,	OHMM/DEG.C	0.0/ 0.0
CO2	93.40	N2	EH/TEMP,	MV/DEG.C	0.000/ 0.0
SO4	16.90				
H2S	0.00				
CL	11.30				
F	4.30	LITERS GAS PER 'KG			
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	MEASURED DOWNHOLE TEMP,	DEGREES C/METERS	FLUID INFLOW
AL	0.0000				DEPTH (METERS)
B	0.0300				
FE	0.0000	CONDENSATE (PPM)			
NH3	0.0000	PH/DEG.C			
H2S	<0.1	CO2			
*		H2S			
*		NA			

IONIC STRENGTH = 0.00377

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.00308483
ANIONS (MOL.EQ.) 0.00358607
DIFFERENCE (%) -15.03

DEEP WATER (PPM)

DEEP STEAM (PPM)

GAS PRESSURES (BARS ABS.)

SI02	89.01	CO2	93.40	CO2	0.00	CO2	0.341E-02
NA	69.50	H2S	0.00	H2S	0.00	H2S	0.000E+00
K	1.04	H2	0.00	H2	0.00	H2	0.000E+00
CA	1.07	O2	0.00	O2	0.00	O2	0.000E+00
MG	0.040	CH4	0.00	CH4	0.00	CH4	0.000E+00
SO4	16.90	N2	0.00	N2	0.00	N2	0.000E+00
CL	11.30	NH3	0.00	NH3	0.00	NH3	0.000E+00
F	4.30					H2O	0.191E+01
DISS.S.	0.00					TOTAL	0.192E+01
AL	0.0000						
B	0.0300					H2O (%)	0.00
FE	0.0000					BOILING PORTION	0.00

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.929	KSO4-	0.924	FE++	0.734	FECL+	0.923
OH-	0.922	F-	0.922	FE+++	0.517	AL+++	0.517
H3SI04-	0.923	CL-	0.921	FE0H+	0.924	ALOH++	0.731
H2SI04--	0.731	NA+	0.923	FE(OH)3-	0.924	AL(OH)2+	0.924
H2BO3-	0.920	K+	0.921	FE(OH)4--	0.730	AL(OH)4-	0.923
HCO3-	0.923	CA++	0.734	FE0H++	0.730	ALSO4+	0.923
CO3--	0.727	MG++	0.742	FE(OH)2+	0.924	AL(SO4)2-	0.923
HS-	0.922	CAHCO3+	0.925	FE(OH)4-	0.924	ALF++	0.731
S--	0.730	MGHCO3+	0.923	FESO4+	0.924	ALF2+	0.924
HSO4-	0.923	CAOH+	0.925	FECL++	0.730	ALF4-	0.923
SO4--	0.725	NGOH+	0.926	FECL2+	0.924	ALF5--	0.727
NASO4-	0.924	NH4+	0.920	FECL4-	0.923	ALF6---	0.489

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-8.304	MG++	0.03	-5.916	FE(OH)3	0.00	0.000
OH-	3.82	-3.648	NACL	0.01	-6.596	FE(OH)4-	0.00	0.000
H4SI04	108.63	-2.947	KCL	0.00	-9.084	FECL+	0.00	0.000
H3SI04-	32.24	-3.470	NASO4-	0.24	-5.687	FECL2	0.00	0.000
H2SI04--	0.09	-6.005	KSO4-	0.01	-7.064	FECL++	0.00	0.000
NAH3SI04-	1.30	-4.957	CASO4	0.10	-6.153	FECL2+	0.00	0.000
H3BO3	0.14	-5.659	MGSO4	0.02	-6.717	FECL3	0.00	0.000
H2BO3-	0.04	-6.236	CACO3	0.54	-5.266	FECL4-	0.00	0.000
H2CO3	1.81	-4.534	MGCO3	0.01	-7.029	FESO4	0.00	0.000
HCO3-	125.07	-2.688	CAHCO3+	0.33	-5.480	FESO4+	0.00	0.000
CO3--	2.07	-4.463	MGHCO3+	0.00	-7.331	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.01	-6.869	ALOH++	0.00	0.000
HS-	0.00	0.000	NGOH+	0.00	-7.002	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-18.972	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.00	-8.913	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	16.61	-3.762	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.964	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	4.30	-3.645	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	11.29	-3.497	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	69.19	-2.521	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	1.04	-4.577	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	0.69	-4.766	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00355

IONIC BALANCE :
CATIONS (MOL.EQ.) 0.00307649
ANIONS (MOL.EQ.) 0.00357547
DIFFERENCE (%) -15.00

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.55

QUARTZ	116.8
CHALCEDONY	87.0
NAK	57.1

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-16.165	99.999	ALBITE LOW	-15.488	99.999	ANALCIME	-12.300	99.999
ANHYDRITE	-5.882	-8.802	CALCITE	-9.641	-9.502	CHALCEDONY	-2.720	-2.947
MG-CHLORITE	-79.174	99.999	FLUORITE	-10.537	-12.262	GOETHITE	-5.198	99.999
LAUMONDITE	-25.654	99.999	MICROCLINE	-17.431	99.999	MAGNETITE	-26.584	99.999
CA-MONTHOR.	-76.947	99.999	K-MONTHOR.	-37.471	99.999	MG-MONTHOR.	-77.881	99.999
NA-MONTHOR.	-37.285	99.999	MUSCOVITE	-19.248	99.999	PREHNITE	-35.591	99.999
PYRRHOTITE	1.133	99.999	PYRITE	-40.911	99.999	QUARTZ	-2.910	-2.947
WAIKITE	-23.561	99.999	WOLLASTONITE	9.759	8.761	ZOISITE	-34.684	99.999
EPIDOTE	-139.305	99.999						

ORKUSTOFNUM JMD
1980-11-14 HORDUR

MADAGASCAR

8000000107 TABALANEHY, NOSY BE, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPH)		STEAM SAMPLE		REFERENCE TEMP.		DEGREES C		0.0 (QTZ)	
PH/DEG.C	7.25/26.0	GAS (VOL.Z)							
SI02	127.20	CO2							
NA	1203.30	H2S		SAMPLING PRESSURE	BARS ABS.				
K	86.70	H2		DISCHARGE ENTHALPY	KJ/OL/KG				
CA	169.30	O2		DISCHARGE	KG/SEC.		0.0		
MG	141.000	CH4							
CO2	1267.70	N2		MEASURED TEMPERATURE	DEGREES C		33.0		
SO4	55.60			RESISTIVITY/TEMP.	OHM/DEG.C		0.0/ 0.0		
H2S	0.20			EH/TEMP.	MV/DEG.C		0.000/ 0.0		
CL	1806.00								
F	0.20	LITERS GAS PER 'KG							
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	/	MEASURED DOWNHOLE TEMP.		FLUID INFLOW			
AL	0.0000			DEGREES C/METERS		DEPTH (METERS)			
B	1.2600	CONDENSATE (PPH)							
FE	0.0000	PH/DEG.C	/						
NH3	0.0000	CO2	0.0		0.0		0.0		0.0
*		H2S	0.0		0.0		0.0		0.0
*		NA	0.0		0.0		0.0		0.0
*			0.0		0.0		0.0		0.0
		CONDENSATE WITH NAOH (PPH)	0.0		0.0		0.0		0.0
		CO2	0.0		0.0		0.0		0.0
		H2S	0.0		0.0		0.0		0.0

IONIC STRENGTH = 0.08426 IONIC BALANCE : CATIONS (MOL.EQ.)0.07310809
 ANIONS (MOL.EQ.)0.07688210
 DIFFERENCE (Z) -5.03

SIHCOR > 2.0

DEEP WATER (PPH)		DEEP STEAM (PPH)		GAS PRESSURES (BARS ABS.)	
SI02	127.21	CO2	1267.70	CO2	0.454E+00
NA	1203.30	H2S	0.20	H2S	0.322E-04
K	86.70	H2	0.00	H2	0.000E+00
CA	169.30	O2	0.00	O2	0.000E+00
MG	140.988	CH4	0.00	CH4	0.000E+00
SO4	55.60	N2	0.00	N2	0.000E+00
CL	1805.85	NH3	0.00	NH3	0.000E+00
F	0.20			H2O	0.489E+01
DISS.S.	0.00			TOTAL	0.535E+01
AL	0.0000				
B	1.2599	H2O (Z)	0.00		
FE	0.0000	BOILING PORTION	0.00		

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.783	KSO4-	0.742	FE++	0.324	FECL4	0.721
OH-	0.712	F-	0.712	FE+++	0.118	AL+++	0.118
H3SI04-	0.721	CL-	0.704	FE0H+	0.736	ALOH++	0.310
H2SI04--	0.310	NA+	0.721	FE(OH)3-	0.736	AL(OH)2+	0.742
H2BO3-	0.694	K+	0.704	FE(OH)4--	0.301	AL(OH)4-	0.729
HCO3-	0.721	CA++	0.324	FE0H++	0.301	ALSO4+	0.729
CO3--	0.289	MG++	0.366	FE(OH)2+	0.742	AL(SO4)2-	0.729
HS-	0.712	CAHCO3+	0.750	FE(OH)4-	0.742	ALF++	0.310
S--	0.301	MGHCO3+	0.721	FESO4+	0.736	ALF2+	0.742
HSD4-	0.729	CAOH+	0.750	FECL+	0.301	ALF4-	0.729
SO4--	0.277	MGOH+	0.756	FECL2+	0.736	ALF5--	0.289
NASO4-	0.742	NH4+	0.694	FECL4-	0.721	ALF6---	0.062

CHEMICAL COMPONENTS IN DEEP WATER (PPH AND LOG MOLE)

H+ (ACT.)	0.00	-7.361	MG++	99.84	-2.386	FE(OH)3	0.00	0.000
OH-	1.30	-4.117	NACL	35.61	-3.215	FE(OH)4-	0.00	0.000
H4SI04	189.64	-2.705	KCL	0.77	-4.987	FECL+	0.00	0.000
H3SI04-	10.10	-3.974	NASO4-	3.11	-4.582	FECL2	0.00	0.000
H2SI04--	0.01	-7.187	KSO4-	0.74	-5.263	FECL++	0.00	0.000
NAH3SI04-	4.47	-4.422	CASO4	3.19	-4.630	FECL2+	0.00	0.000
H3BO3	6.93	-3.951	MGSO4	35.52	-3.530	FECL3	0.00	0.000
H2BO3-	0.27	-5.347	CACO3	35.30	-3.453	FECL4-	0.00	0.000
H2CO3	207.89	-2.475	MGCO3	16.59	-3.706	FESO4	0.00	0.000
HCO3-	1298.20	-1.672	CAHCO3+	248.56	-2.609	FESO4+	0.00	0.000
CO3--	3.38	-4.250	MGHCO3+	95.06	-2.953	AL+++	0.00	0.000
H2S	0.02	-6.139	CAOH+	0.14	-5.618	ALOH++	0.00	0.000
HS-	0.17	-5.289	MGOH+	3.59	-4.061	AL(OH)2+	0.00	0.000
S--	0.00	-13.157	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-16.603	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSD4-	0.00	-7.690	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	21.96	-3.641	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.143	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	0.20	-4.978	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	1783.88	-1.298	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	1187.82	-1.287	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	86.08	-2.657	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	55.59	-2.858	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.07622 IONIC BALANCE : CATIONS (MOL.EQ.)0.06851774
 ANIONS (MOL.EQ.)0.07236857
 DIFFERENCE (Z) -5.47

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	147.1
CHALCEDONY	118.0
NAK	165.3

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.462 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.	TEOR.	CALC.	TEOR.	CALC.		
ADULARIA	-14.896	99.999	ALBITE LOW	-14.304	99.999	ANALCIME	-11.355	99.999
AMHYDRITE	-6.382	-7.547	CALCITE	-10.252	-8.137	CHALCEDONY	-2.520	-2.705
MG-CHLORITE	-78.578	99.999	FLUORITE	-10.586	-13.598	GOETHITE	-3.802	99.999
LAUMONDITE	-23.922	99.999	MICROCLINE	-15.991	99.999	MAGNETITE	-24.090	99.999
CA-MONTHOR.	-66.961	99.999	K-MONTHOR.	-32.219	99.999	MG-MONTHOR.	67.799	99.999
NA-MONTHOR.	-32.146	99.999	MUSCOVITE	-16.958	99.999	PREHNITE	-34.394	99.999
PYRRHOTITE	0.973	99.999	PYRITE	-37.594	99.999	QUARTZ	-2.659	-2.705
WAIRAKITE	-22.426	99.999	WOLLASTONITE	8.978	8.670	ZOISITE	-33.449	99.999
EPIDOTE	-138.521	99.999						

ORKUSTOFNUN JHD
1980-11-21 HORDUR

MADAGASCAR

800000109 REJIFO, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	7.28/26.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
SI02	84.20	CO2	SAMPLING PRESSURE	BARS ABS.	
NA	1613.80	H2S	DISCHARGE ENTHALPY	MJ/OL/KG	
K	95.90	H2	DISCHARGE	KG/SEC.	0.0
CA	143.00	O2	MEASURED TEMPERATURE	DEGREES C	37.0
MG	221.500	CH4	RESISTIVITY/TEMP.	OHMM/DEG.C	0.0/ 0.0
CO2	190.10	N2	EH/TEMP.	MV/DEG.C	0.000/ 0.0
SO4	268.00				
H2S	0.20				
CL	2855.00				
F	0.29				

DISS.SOLIDS	0.00	LITERS GAS PER 'KG	MEASURED DOWNHOLE TEMP.	FLUID INFLOW
AL	0.0000	CONDENSATE/DEG.C	DEGREES C/METERS	DEPTH (METERS)
B	1.5900			
FE	0.0000	CONDENSATE (PPM)	0.0	0.0
NH3	0.0000	PH/DEG.C	0.0	0.0
*		CO2	0.0	0.0
*		H2S	0.0	0.0
*		NA	0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0

IONIC STRENGTH = 0.10634 IONIC BALANCE : CATIONS (MOL.EQ.)0.09637795
ANIONS (MOL.EQ.)0.08839551
DIFFERENCE (%) 8.64

SINCR > 2.0

DEEP WATER (PPM)	DEEP STEAM (PPM)	GAS PRESSURES (BARS ABS.)
SI02 84.21	CO2 190.10	CO2 0.618E-01
NA 1613.80	H2S 0.20	H2S 0.369E-04
K 95.90	H2 0.00	H2 0.000E+00
CA 143.00	O2 0.00	O2 0.000E+00
MG 221.482	CH4 0.00	CH4 0.000E+00
SO4 267.99	N2 0.00	N2 0.000E+00
CL 2854.76	NH3 0.00	NH3 0.000E+00
F 0.29		H2O 0.252E+01
DISS.S. 0.00		TOTAL 0.258E+01
AL 0.0000		
B 1.5899	H2O (%) 0.00	
FE 0.0000	BOILING PORTION 0.00	

ACTIVITY COEFFICIENTS IN DEEP WATER

H+	0.780	KSO4-	0.735	FE++	0.316	FECL+	0.712
OH-	0.703	F-	0.703	FE+++	0.116	AL+++	0.116
H3SI04-	0.712	CL-	0.693	FEOH+	0.729	AL(OH)++	0.302
H2SI04--	0.302	NA+	0.712	FE(OH)3-	0.729	AL(OH)2+	0.735
H2RO3-	0.682	K+	0.693	FE(OH)4--	0.292	AL(OH)4-	0.721
HCO3-	0.712	CA++	0.316	FEOH++	0.292	ALSO4+	0.721
CO3--	0.279	MG++	0.361	FE(OH)2+	0.735	AL(SO4)2-	0.721
HS-	0.703	CAHCO3+	0.744	FE(OH)4-	0.735	ALF++	0.302
S--	0.292	MGHCO3+	0.712	FES04+	0.729	ALF2+	0.735
H2SO4	0.721	CAOH+	0.744	FECL++	0.292	ALF4-	0.721
SO4--	0.266	MGOH+	0.751	FECL2+	0.729	ALF5--	0.279
NASO4-	0.735	NH4+	0.682	FECL4-	0.712	ALF6---	0.057

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-7.185	MG++	178.38	-2.134	FE(OH)3	0.00	0.000
OH-	0.49	-4.539	NACL	56.26	-3.017	FE(OH)4-	0.00	0.000
H4SI04	128.72	-2.873	KCL	0.91	-4.915	FECL+	0.00	0.000
H3SI04-	4.08	-4.368	NASO4-	13.46	-3.947	FECL2	0.00	0.000
H2SI04--	0.00	-7.740	KSO4-	2.52	-4.730	FECL++	0.00	0.000
NAH3SI04-	2.28	-4.714	CASO4	18.47	-3.868	FECL2+	0.00	0.000
H3RO3	8.85	-3.844	MGS04	178.31	-2.829	FECL3	0.00	0.000
H2RO3-	0.24	-5.407	CACO3	4.32	-4.365	FECL4-	0.00	0.000
H2CO3	31.09	-3.300	MGCO3	2.25	-4.573	FES04	0.00	0.000
HCO3-	187.96	-2.511	CAHCO3+	44.07	-3.361	FES04+	0.00	0.000
CO3--	0.44	-5.136	MGHCO3+	19.19	-3.648	AL+++	0.00	0.000
H2S	0.03	-6.047	CAOH+	0.08	-5.862	ALOH++	0.00	0.000
HS-	0.16	-5.304	MGOH+	1.66	-4.397	AL(OH)2+	0.00	0.000
S--	0.00	-13.543	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-16.172	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
H2SO4-	0.01	-7.214	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	100.01	-2.983	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-8.046	FEOH+	0.00	0.000	ALF++	0.00	0.000
F-	0.29	-4.817	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	2820.20	-1.099	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	1588.63	-1.161	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	94.69	-2.616	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	118.31	-2.530	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.10015 IONIC BALANCE : CATIONS (MOL.EQ.)0.09280373
ANIONS (MOL.EQ.)0.08482734
DIFFERENCE (%) 8.98

CHEMICAL GEOTHERMOMETERS DEGREES C

QUARTZ	125.5
CHALCEDONY	95.9
NAK	147.8

OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.398 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-15.798	99.999	ALBITE LOW	-15.147	99.999
ANHYDRITE	-6.015	-6.588	CALCITE	-9.800	-8.720
MG-CHLORITE	-78.957	99.999	FLUORITE	-10.544	-12.969
LAUMONDITE	-25.158	99.999	MICROCLINE	-17.015	99.999
CA-MONTHOR.	-74.139	99.999	K-MONTHOR.	-35.990	99.999
NA-MONTHOR.	-35.840	99.999	MUSCOVITE	-18.601	99.999
PYRRHOTITE	1.083	99.999	PYRITE	-39.948	99.999
WAIKAITITE	-23.236	99.999	WOLLASTONITE	9.532	8.467
EPIDOTE	-138.974	99.999			
			ANALCIME	-12.027	99.999
			CHALCEDONY	-2.662	-2.873
			GOETHITE	-4.824	99.999
			MAGNETITE	-25.908	99.999
			MG-MONTHOR.	-75.051	99.999
			PREHNITE	-35.237	99.999
			QUARTZ	-2.839	-2.873
			ZOISITE	-34.329	99.999

ORKUSTOFNUN JHD
1980-11-14 HORDUR

MADAGASCAR

8000000114 MALAILAY, MADAGASCAR.

PROGRAM WATCH2.

WATER SAMPLE (PPM)

STEAM SAMPLE

PH/DEG.C	6.80/16.0	GAS (VOL.%)	REFERENCE TEMP.	DEGREES C	0.0 (QTZ)
SI02	53.60	CO2			
NA	106.70	H2S	SAMPLING PRESSURE	BARS ABS.	
K	7.50	H2	DISCHARGE ENTHALPY	KJ/OL/KG	
CA	48.60	O2	DISCHARGE	KG/SEC.	0.0
MG	5.690	CH4			
CO2	36.50	N2	MEASURED TEMPERATURE	DEGREES C	36.0
SO4	218.10		RESISTIVITY/TEMP.	OHM/DEG.C	0.0/ 0.0
H2S	0.00		EH/TEMP.	MV/DEG.C	0.000/ 0.0

F	1.10	LITERS GAS PER 'KG	MEASURED DOWNHOLE TEMP.	FLUID INFLOW
DISS.SOLIDS	0.00	CONDENSATE/DEG.C	DEGREES C/METERS	DEPTH (METERS)
AL	0.0000			
B	0.0100	CONDENSATE (PPM)	0.0	0.0
FE	0.0000	PH/DEG.C	0.0	0.0
NH3	0.0000	CO2	0.0	0.0
H2S	<0.1	H2S	0.0	0.0
*		NA	0.0	0.0
*			0.0	0.0
			0.0	0.0
		CONDENSATE WITH NAOH (PPM)	0.0	0.0
		CO2	0.0	0.0
		H2S	0.0	0.0

IONIC STRENGTH = 0.01080 IONIC BALANCE : CATIONS (MOL.EQ.)0.00745294
 ANIONS (MOL.EQ.)0.00726825
 DIFFERENCE (%) 2.51

DEEP WATER (PPM)	DEEP STEAM (PPM)	GAS PRESSURES (BARS ABS.)
SI02 53.60	CO2 36.50	CO2 0.254E-01
NA 106.70	H2S 0.00	H2S 0.000E+00
K 7.50	H2 0.00	H2 0.000E+00
CA 48.60	O2 0.00	O2 0.000E+00
MG 5.690	CH4 0.00	CH4 0.000E+00
SO4 218.10	N2 0.00	N2 0.000E+00
CL 83.49	NH3 0.00	NH3 0.000E+00
F 1.10		H2O 0.122E+01
DISS.S. 0.00		TOTAL 0.124E+01
AL 0.0000		
B 0.0100	H2O (%) 0.00	
FE 0.0000	BOILING PORTION 0.00	

ACTIVITY COEFFICIENTS IN DEEP WATER

HI	0.898	KSO4-	0.889	FE++	0.631	FECL+	0.884
OH-	0.883	F-	0.883	FE+++	0.385	AL+++	0.385
H3SI04-	0.884	CL-	0.881	FE0H+	0.887	AL0H++	0.626
H2SI04--	0.626	NA+	0.884	FE(OH)3-	0.887	AL(OH)2+	0.889
H2BO3-	0.879	K+	0.881	FE(OH)4--	0.622	AL(OH)4-	0.886
HCO3-	0.884	CA++	0.631	FE0H++	0.622	ALSO4+	0.886
CO3--	0.618	MG++	0.646	FE(OH)2+	0.889	AL(SO4)2-	0.886
HS-	0.883	CAHCO3+	0.890	FE(OH)4-	0.889	ALF++	0.626
S--	0.622	MGHCO3+	0.884	FESO4+	0.887	ALF2+	0.889
HSO4-	0.886	CAOH+	0.890	FECL++	0.622	ALF4-	0.886
SO4--	0.613	NGOH+	0.892	FECL2+	0.887	ALF5--	0.618
NASO4-	0.889	NH4+	0.879	FECL4-	0.834	ALF6---	0.339

CHEMICAL COMPONENTS IN DEEP WATER (PPM AND LOG MOLE)

H+ (ACT.)	0.00	-6.731	MG++	2.88	-3.926	FE(OH)3	0.00	0.000
OH-	0.07	-5.394	NACL	0.12	-5.685	FE(OH)4-	0.00	0.000
H4SI04	85.12	-3.053	KCL	0.00	-7.495	FECL+	0.00	0.000
H3SI04-	0.59	-5.204	NASO4-	2.91	-4.612	FECL2	0.00	0.000
H2SI04--	0.00	-9.295	KSO4-	0.63	-5.335	FECL++	0.00	0.000
NAH3SI04-	0.03	-6.546	CASO4	32.61	-3.621	FECL2+	0.00	0.000
H3BO3	0.06	-6.037	MGSO4	13.76	-3.942	FECL3	0.00	0.000
H2BO3-	0.00	-8.183	CACO3	0.13	-5.892	FECL4-	0.00	0.000
H2CO3	15.05	-3.615	MGCO3	0.00	-7.332	FESO4	0.00	0.000
HCO3-	33.79	-3.257	CAHCO3+	3.06	-4.519	FESO4+	0.00	0.000
CO3--	0.02	-6.512	MGHCO3+	0.08	-6.025	AL+++	0.00	0.000
H2S	0.00	0.000	CAOH+	0.01	-7.018	ALOH++	0.00	0.000
HS-	0.00	0.000	NGOH+	0.01	-6.897	AL(OH)2+	0.00	0.000
S--	0.00	0.000	NH4OH	0.00	0.000	AL(OH)3	0.00	0.000
H2SO4	0.00	-15.201	NH4+	0.00	0.000	AL(OH)4-	0.00	0.000
HSO4-	0.03	-6.553	FE++	0.00	0.000	ALSO4+	0.00	0.000
SO4--	181.29	-2.724	FE+++	0.00	0.000	AL(SO4)2-	0.00	0.000
HF	0.00	-7.135	FE0H+	0.00	0.000	ALF++	0.00	0.000
F-	1.10	-4.238	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	83.42	-2.628	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NA+	106.08	-2.336	FE(OH)4--	0.00	0.000	ALF4-	0.00	0.000
K+	7.32	-3.728	FE(OH)++	0.00	0.000	ALF5--	0.00	0.000
CA++	37.73	-3.026	FE(OH)2+	0.00	0.000	ALF6---	0.00	0.000

IONIC STRENGTH = 0.00980 IONIC BALANCE : CATIONS (MOL.EQ.)0.00675295
 ANIONS (MOL.EQ.)0.00675012
 DIFFERENCE (%) 2.96

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T DEGREES KELVIN = 2.64

QUARTZ	104.9
CHALCEDONY	75.0
NAK	162.7

OXIDATION POTENTIAL (VOLTS) : EH H2S= 99.999 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999

LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER

	TEOR.	CALC.		TEOR.	CALC.		TEOR.	CALC.
ADULARIA	-16.759	99.999	ALBITE LOW	-16.638	99.999	ANALCIME	-12.742	99.999
ANHYDRITE	-5.681	-6.163	CALCITE	-9.410	-9.948	CHALCEDONY	-2.816	-3.053
MG-CHLORITE	-79.599	99.999	FLUORITE	-10.536	-11.811	GOETHITE	-5.766	99.999
LAUMONDITE	-26.453	99.999	MICROCLINE	-18.109	99.999	MAGNETITE	-27.621	99.999
CA-MONTHOR.	-81.369	99.999	K-MONTHOR.	-37.808	99.999	MG-MONTHOR.	-82.330	99.999
NA-MONTHOR.	-39.566	99.999	MUSCOVITE	-20.274	99.999	PREHNITE	-36.176	99.999
PYRRHOTITE	1.220	99.999	PYRITE	-42.487	99.999	QUARTZ	-3.028	-3.053
WAIKAKITE	-24.082	99.999	WOLLASTONITE	10.133	7.183	ZOISITE	-35.256	99.999
EPIDOTE	-140.003	99.999						