IMPLICATIONS OF SOLUTION-MINERAL EQUILIBRIA ON THE EXPLOITATION OF THE S-NEGROS GEOTHERMAL FIELD, PHILIPPINES

Oliver T. Jordan* UNU Geothermal Training Programme National Energy Authority Grensasvegur 9, 108 Reykjavik ICELAND

* Permanent Address: Philippine National Oil Company (PNOC) Energy Development Corporation (EDC) Geothermal Division PNOC Energy Companies Building Merritt Road Fort Bonifacio, Metro Manila PHILIPPINES

ABSTRACT

Representative chemical data from production boreholes in the Southern Negros Geothermal Field, Philippines, were studied to assist in the evaluation of certain solute-mineral equilibria and the calibration and selection of the most applicable chemical geothermometer. Anhydrite and quartz are shown to be in equilibrium with the deep fluid, while calcite saturation seems to be governed by temperature and mixing with cooler fluid. A computer simulation of boiling and cooling processes suggests no potential calcite deposition, whereas problems of amorphous silica scaling could occur at a re-injection or production separation temperature of 150 °C and lower. Empirically derived relation of aqueous acid molecules and cation to proton ratios with temperatures, as obtained using chemical data in Iceland, fits well for the aqueous H4SiO4 and H2CO3 species in fluids of Southern Negros, but gives significant deviations for H_2S , H_2SO_4 , and the cation to proton ratios. The deviations are attributed to the mechanisms of boiling and degassing, a different rock leaching property, and mixing with cold water. Calibration of various chemical geothermometers using measured temperatures at main production zone as reference, shows that the pressure sensitive silica geothermometer of Ragnarsdottir and Walther(1982) and the Na/K geothermometer of Arnorsson, et al. 1982 c) using computed activities of Na and K yield the least mean and standard deviations. Applying the Chloride-enthalpy mixing models of Fournier (1977),suggests cold meteoric water recharge from the northwest, picking up heat from the rock before mixing with the outflowing hydrothermal fluid within the vicinity of Sogongon and Nasuji. True reservoir temperatures are estimated to be at least 300 °C.

TABLE OF CONTENTS

ABSTRACT	3
1 INTRODUCTION	
1.1 Scope and objective of work	9
1.2 Methods of collection and analysis	10
2 THE SOUTHERN NEGROS GEOTHERMAL FIELD	
2.1 Introduction	14
2.1.1 Regional geological setting	14
2.1.2 Brief status of geothermal development	17
2.2 Review of previous geochemical studies	17
2.2.1 Geochemistry of thermal manifestations	19
2.2.2 Geochemistry of exploration and step-out	
wells	20
2.2.3 Geochemistry of production wells	21
3 SOLUTION-MINERAL EQUILIBRIA	
3.1 Introduction	29
3.1.1 Applications of solute-mineral equilibria	
studies	29
3.1.2 Mineral saturation state of deep fluid	35
3.1.3 Empirical relation of aqueous species with	
temperature	41
3.2 Geothermometry	45
3.2.1 Quartz geothermometry	45
3.2.2 Cation geothermometry	49
3.2.3 CO ₂ geothermometry	51
3.2.4 Chioride-enthalpy mixing model	51
3.3 Isochemical and isothermal contours	53
3.4 Conclusions	59
4 RECOMMENDATIONS	61
ACKNOWLEDGEMENTS	62
REFERENCES	63

Page

APPENDIX:	Computer printout of WATCH 1 programme	
	of representative chemical analysis of	
	production boreholes	68

LIST OF FIGURES

1.	Typical discharge test assembly of production bore-	
	holes in the S-Negros Geothermal Field	11
2.	Geological map of Negros Island showing main	
	structures and the distribution of volcanoes	15
3.	Map of the Palinpinon field showing resistivity	
	contours, distribution of thermal springs, and	
	location of well sites	16
4.	Map of the Palinpinon field showing main structures,	
	altered grounds, location of wellheads, pads and	
	bottomholes, and the 112.5 Mwe power plant	18
5.	Cross sectional map of the Palinpinon field showing	
	production zones	23
6.	Typical variation with time of chemically calculated	
	temperatures, deep water enthalpy, deep water	
	chloride, and CO_2 and H_2S in total discharge, of a	
	production well	26
7.	State of anhydrite saturation of the deep water at	
	measured temperatures	36
8.	State of calcite saturation of the deep water at	
	measured temperatures	36
9.	State of quartz and amorphous silica saturation at	
	boiling and cooling	38
10.	State of calcite saturation at boiling and cooling	38

11. State of anhydrite saturation at boiling and cooling 39

- 15. Iso T Si(OH)₄*2H₂O map of the Palinpinon field 55

- 18. Isotherms at 1000m bsl of the Palinpinon field 58

LIST OF TABLES

 Analytical methods for steam and water samples 12
Physical measuements data and interpretations of production wells in S-Negros, showing production zones, measured temperatures, and power potential (after EDC-KRTA, 1982) 22
Chemical composition of production well fluids at

- 5. Table showing equations of various chemical geothermometers used to compare with the measured temperatures of main production zone at S-Negros ... 46
 6. Table showing chemically calculated and measured
- Table showing mean and standard deviations of chemically calculated temperatures from measured temperatures at main production zones in S-Negros .. 48

1 INTRODUCTION

1.1 Scope and obejctive of work

The Philippines is one of the many countries presently engaged in an accelerated development programme to harness geothermal The revised energy as an indigenous power source. energy development strategy calls for an installed 1,774 MW of electricity at the end of 1985. Contributory to this ambitious plan is the availment of foreign expertise and assistance, as well as the foreign training of selected Filipinos in the leading countries engaged in geothermal exploration, development, and utilization. In line with this, the author was awarded a United Nations University Fellowship to attend the 1982 UNU Geothermal Training Programme held at the National Energy Authority in Reykjavik, Iceland. He attended the specialized course in the geochemistry of thermal fluids.

After a five week introductory lecture series covering the scientific, engineering, and economic aspects in various geothermal exploration and exploitation, the author received specialized training in the following topics: water and steam sampling from natural thermal manifestations and production boreholes (3 weeks); analytical methods and procedures (3 weeks); rock-fluid chemistry and chemical thermodynamics computer compilation of (2 weeks): analytical results (2 weeks); and computer approach to the interpretation of geothermal well discharges (2 weeks). This report represents a research project carried out during the last month of the training programme.

Chemical data from production boreholes in the Southern Negros geothermal field, Philippines, were studied to assist in their overall evaluation. Since the study of aquifer fluid chemistry involves lengthy and complex equations, calculations, and especially iterative procedures, a computer programme developed at the University of Iceland and the National Energy Authority, was used (Arnorsson, et al. 1982 a). This topic was selected to train the author in such a specialized field of studies commonly used both during the exploration and the exploitation stages in geothermal development.

1.2 Methods of collection and analysis

All analytical procedures were performed at the geochemical laboratories of PNOC-EDC Geothermal Division at Manila and Southern Negros. The following is a brief description of the methods used in water and steam sampling.

Figure 1 shows the typical discharge test assembly of production the Southern Negros geothermal field. boreholes in The two-phase fluid from the well head is by-passed to a horizontal discharge pipe and allowed to discharge to atmospheric pressure through a twin-tower cyclone silencer equipped with a rectangular weir and a trapezoidal cippoletti weir to measure water flow rate. Two sampling probes are located on the horizontal by-pass pipe consisting of either a 3/4" or 1/2" inside diameter nipple and a gate valve to control fluid flow Generally, water samples were collected at during sampling. atmospheric pressure and local boiling point (i.e. in the weirbox), and at the low pressure probe.

Water samples could not be collected at the high pressure point since it was experienced that steam carry over with the liquid phase could not be avoided, probably due to the proximity of this probe to the T-junction of the wellhead, where turbulent flow of both water and steam phases makes effective separation impossible. A weber cyclone separator was used to carry out the steam and water sampling under pressure. Sampling pressures ranged from 2-12 bars absolute. The difference between fluid pressure within the pipe and the sampling pressure were kept to a minimum to reduce the possibility of steam flashing.

Water sample treatment consists of acidification to pH 2-3 for the analysis of silica and the main cations and storing in polyethylene bottles;untreated samples were analysed for boron, chloride, and sulfate; water samples collected into air-tight



FIG 1. DISCHARGE TEST ASSEMBLY IN THE PALINPINON FIELD, SOUTHERN NEGROS

(modified from Baltazar, 1980)

F. 20034

TABLE 1

Analytical methods for steam and water samples

	Elemen	t Method
Steam phase	C02	Potentiometric titration from pH 8.25-3.80 using standard 0.1N hydrochloric acid.
	H ₂ S	Back titration with 0.01N sodium thiosulfate in acid solution(+2N sulfuric acid) after addition of 0.01N iodine solution
	NH 3	Specific ion sensitive electrode
	Cl	Mohr titration using 0.01N silver nitrate with potassium chromate-dichromate buffer indicator
Water	pН	Glass electrode
phase	Li	Atomic absorption spectrophotometry
	Na	Atomic absorption spectrophotometry
	к	Atomic absorption spectrophotometry
	Ca	Atomic absorption spectrophotometry
	Mg	Atomic absorption spectrophotometry
	Rb	Atomic absorption spectrophotometry
	Cs	Atomic absorption spectrophotometry
	Cl	Mohr titration using 0.1N silver nitrate standard solution with potassium chromate/ dichromate buffer indicator
	50 ₄	Ultra-violet spectrophotometry by liberation of chromate ions through pptn. of sulfate using barium chromate
	В	Potentiometric titration with 0.025N sodium hydroxide to pH 7.30 after addition of excess mannitol
	Si0 ₂	Ultra violet spectrophotometry through colorimetric reaction using ammonium molybdate
	c0 ₂	Double potentiometric titration from pH 8.25–3.80 using 0.02N hydrochloric acid
	H ₂ S	Same as for steam phase

r

glass bottles with a 6-8" long butyl rubber tubing equipped with aluminum clips (air free samples) were taken mainly for the analysis of pH, total sulfide, and total carbonate. Steam samples were collected both at the high and low pressure points, into evacuated 2-3 liters boro-silicate flasks containing a measured volume of 70 % sodium-hydroxide solution to bring the CO_2 and H_2S gases of the steam phase into solution. Separate untreated steam condensates were similarly collected into 3-All analytical liters evacuated flasks for ammonia analysis. procedures and methods used are summarized in Table 1. Relevant bore output data such as discharge enthalpies and total mass flow rates were also measured along with the time of sampling, using the critical lip pressure method developed by James (1962).

2 THE SOUTHERN NEGROS GEOTHERMAL FIELD

2.1 Introduction

2.1.1 Regional geological setting

The Southern Negros Geothermal Field (SNGF) covers almost one half of the peninsular arm of Negros Island, and encompasses a total reservation area of approximately 133,000 hectares (Fig. 2) The SNGF is situated within a localized graben that forms the Okoy river-valley, located in between the merging flanks of two dormant andesitic volcanoes, namely the Cuernos de Negros to the south, and mount Balinsasayao to the north. The whole field is dissected by a series of NNW trending right lateral faults, NE trending left late ral faults, and a system of step faults striking NW and NE. The first two fault patterns are believed to be sympathetic to the Philippine fault, while the third pattern could be due to a failure enhanced by local coupling stresses that could have been initiated by lateral movements along shear planes (Bagamasbad, 1979; Reyes and Tolentino, 1981).

The SNGF consists of two promising thermal areas, namely the Palinpinon field, located on the eastern section of the Okoy river valley, and the Baslay de Dauin area, situated within a ring plain southeast of the Cuernos volcano. The distribution of thermal springs and resistivity contours are shown in Fig. 3. These manifestations, in the form of numerous hot and warm springs, alteration patches, and steaming vents, are broadly contained within the two thermal areas, but are more numerous and intense along the 9 km length of the Okoy river, the southern tributaries of drain Northern which the flank of the large Plio-Pleiostocene composite volcano of Cuernos de Negros. Dipole-dipole and Schlumberger resistivity surveys with electrode spacings of AB/2 equals 250 and 500 m identified four distinct anomalies (5, 10, 20, and 50 ohm-meter), all



converging towards the Cuernos volcano, suggesting that this may be the ultimate heat source of the field (KRTA, 1977).

2.1.2 Brief status of geothermal development.

The Palinpinon field has been given priority over Baslay de Dauin in exploration and production drilling due to the more impressive thermal areas and encouraging geological, geophysical, and geochemical results. In April, 1982 a total of 26 wells had been drilled (vertical and directional), while four others are currently being drilled. Due to the steep topography in Puhagan which severely limits the number of suitable sites for vertical wells, directional drilling has become common practice. Thus all targets can be reached from drillsites close to the location of the power station. These wells penetrate a series of intermediate volcanics and volcaniclastics before encountering a fossileferous sedimentary formation and/or a diorite-monzonite pluton (Reyes and Tolentino, 1981). Fig. 4 shows the main structures, the location of all wellheads, and the bottomholes of the directionally drilled producton wells that will be considered in this report.

2.2 Review of previous geochemical studies.

The chemistry of surface thermal manifestations and early exploration wells has been described by previous workers (Glover, 1975; Camales, 1979; Ruaya, 1980). Production borehole geochemistry studies were described by Jordan (1981 a,b,c) and Clemente (1982 a,b). A brief summary will be given of the general interpretations that have been made.

2.2.1 Geochemistry of surface thermal manifestations.

Figures 3 and 4 show the distribution of hot and warm springs of the SNGF. On the basis of their chemical composition, three distinct types have been identified:

- Low lying, near neutral to slightly alkaline, high sodium chloride springs of Palinpinon and Cambucal.
- Near neutral to acidic, high sulfate (up to 3,000 ppm) waters with significant chloride (780 ppm) of Tagbac-Magaso, Baslay and Nagpantaw at moderate elevations.
- Acid, low chloride-high sulfate steam heated springs of Lagunao, Sogongon, and Kaipohan, at high elevations.

The first type is attributed to a direct leakage from the aquifer fluid, and hence, believed to reflect underground hydrothermal conditions. Chemical geothermometry and mixing models yield maximum and minimum subsurface temperatures of 279-173°C (KRTA, 1979).

The second type is believed to be associated with the hot chloride water but could have been diluted with near surface ground water. The neutral springs of this type could be formed when the hydrothermal fluids migrate upward via a formation of restricted permeability, where between rock and fluid neutralization reactions are enhanced by the slow flow rates, resulting in neutral emissions at the surface. The acid springs could be formed when steam separates from the water table of the hot chloride body and dilutes near surface ground water during upward flow.

The third type is evidently steam heated surface ground water and does not reflect deep condititons. The high sulfate and low pH could be quantitatively explained through the oxidation of hydrogen sulfide gas in the steam to sulfuric acid upon contact with oxygen containing meteoric water:

$$H_2S + 20_2 = 2H^+ + S0_4^{--}$$

Glover (1975) concluded that the type of discharge could be controlled by elevation and permeability, and Barnett(1980) suggests a steam cap to be responsible for the steam heated springs.

2.2.2 Geochemistry of exploration and step-out wells.

Early exploration and step-out wells (N1 to N3, OK-2 to OK-5) intercepted higher saline fluids than the least diluted springs of Palinpinon and Cambucal, a consistent sodium chloride water containing variable concentrations of sulfate with a mineralization of about seven percent of total dissolved solids. The absolute chemical components vary slightly for each well and yet show relatively uniform ratios of non-reactive elements e.g. Cl/B, suggesting a single source of parent water undergoing varying degrees of mixing and dilution with cold ground water during ascent. An evidence for mixing is the linear relation between the absolute chloride content and quartz calculated temperatures (KRTA, 1977). Temperature dependent and reactive constituents e.g. Na, K, SiO₂ vary in direct proportion to the temperature of the deep water at any point, which is believed to range from 170°C to possibly 300°C. Wells N1 and N2 however, encountered problems with calcite deposition and output testing did not last long enough to allow any geochemical monitoring with time. Such deposition problems were correlated to the presence of abundant calcite that has crystallized in open fractures as reported from the petrological logs of cores that were cut between the major loss zones of N1. A similar problem was predicted for N3, (Glover, 1975, Barnett, 1980), but no indications of drastic decline in total mass flow rates been observed. Consequently, no problems of calcite have scaling have been encounterd in this well. The maximum measured temperatures for N1, N2, N3, OK-2 and OK-5 were 195°C, 163°C, 238°C, 247°C and 310°C, respectively. All

geochemical data point to an easterly outflow of hot chloride water from west to east. Each well intercepted this flow regime and chemically calculated temperatures which were generally higher than measured values at conditions of stable flow, indicated that higher temperatures could exist towards the southwest. Preliminary isochemical plots of Obusan (1980) suggests a major upwelling zone within the vicinity of OK-5.

2.2.3 Geochemistry of production wells

Information on the subsurface chemistry of the area has updated with the sucessful discharge of deep been production wells. From 1980 to the first half of 1982, a total of 14 wells had undergone medium and long term discharge tests. These wells initially undergo a 1-2 month discharge period, followed by a successive clearing throttle series with the primary objective of examining variations in bore output characteristics in response to changes in wellhead pressures and end pipe diameters. Wells OK-5, PN13D, and OK-7 are currently utilized to drive the 3x1.5MW non-condensing turbines, which started operating in 1981 and 1982, while PN17D, PN15D, PN19D, NJ1D, and OK-8 are undergoing or have just completed their respective medium term discharge tests. OK-12D and OK-2 are used as reinjection wells. The boreholes in Southern Negros show slight two-phase conditions, except for SG1, OK-12D, PN13D, which appear to draw production from a single phase fluid. These wells have a discharge enthalpy ranging from 1050 to 1350 kJ/kg at wellhead pressures of 4-12 bars absolute; only OK-5 shows extreme two-phase conditions with an average discharge enthalpy of 1900 kj/Kg under fully opened conditions. Most wells encounter two major permeable zones at depth which is referred to as the main and secondary production zones (EDC-KRTA, 1982). Table 2 shows the physical measurements data of all production wells in S-Negros and Fig. 5 shows a cross section map of the SNGF showing these production zones.

Table 2.

Physical	measurements.	, data and	interpreta	tions of	production wells
in S- Neo	gros, showing	production	zones and	measured	temperatures

Well Depth		Loss zones (m)**	Main Production ***	Measure	d tempe	ratures(°C)	Power rating	
No.	(m)	main /secondary	zones(m)	a	b	с	M₩e	
0K - 7 0K - 9D	2883 2889	2600-2882/1500-1700 2400-2600/1600-1800	2600 2400	268 306 226	318 332 270	318 291 259	12.5 6.4 6.8	
0K - 100 0K - 12D PN13D PN15D PN17D	2798 2854 2807	1500-1750/2900-3019 1400-1700/2000 1600-1900/2000-2854 1500-1600/2200-2806	2013 2000 1600	243 236 265 281	282 317 276 290	250 268 274 245	4.4 4.6 7.5 4.5	
0K-5 0K-6 0K-8 NJ1D	1975 2771 2982 2848	1450-1550/1100-1200 2300-2770/1340-1550 2300-2400/1700-1900 *2050-2400/1325-1610	1550 2550 2450	310 254 282 243	290 285 282	264 285 244	8.2 10.1 3.0	
SG-1 SG-2	2763 2945	2550-2650/1550-1650 2050-2150/1400-1600	2650 1400	278 275	277 276	277 275	5.5 10.1	

- ^x Data available only from drilling logs
- ** Loss zones indicate zones of water losses deduced from pressure and temperature logs during completion testing of the well.
- ***Refers to the zone which dominates production at maximum discharge rate of the well; deduced from temperature and pressure logs at flowing conditions.

- a Maximum measured well temp. before discharge
- b Maximum measured well temp. after discharge
- c Maximum measured temp. of main production zone in flowing conditions

The typical fluid chemistry is presented in Table 3. The wells are grouped on the basis of their respective locations, i.e. the Puhagan, Nasuji, and Sogongon areas.

Obtaining representative chemical data from a well is hindered by several factors. Fig. 6 shows the typical variations of chemically calculated subsurface temperatures, deep water enthalpy, chloride in total discharge, and the gas components (CO₂ and H_2S) in total flow with the normal duration of a discharge test of a well. Because of the large amount of fluids injected into the geothermal reservoir during drilling and completion tests, a well fluid is not representative until after approximately two months of full discharge. Another important factor to be taken into consideration is the mixing between aquifers. The existence of two production zones at a temperature difference of about 40-50°C both contributing to the total flow results in a mixed fluid at the surface sampling point.

The criteria for selecting representative data from individual wells are thus a) a fully stabilized chemistry and b) a sample point where only the major production zone dominates bulk of the discharge, which, according to experience from temperature pressure logs at flowing conditions, occurs at throttled conditions. These criteria will also minimize the effects of excess enthalpies. A11 chemical data in Table 3 is taken under these conditions. The fluids are relatively neutral (pH 6-7) but contain high amounts of sodium, potassium, silica, and chloride. Significant amounts of the alkali metals are also present (Li, Rb, Cs), but magnesium, bicarbonate, and sulfate, though variable, are low. In the steam phase, carbon dioxide comprises more than 90% of the total non condensible gases, whereas hydrogen sulfide and ammonia 2-4 %. Following is а summary of the comprises interpretations about the reservoir fluid that have been made:

debelig

Table 3

Chemical composition of production well fluids at S-Negros field (all concentrations in parts per million)

		-	-								-			1
H2S	0.10	1	4	82.6	10.2	5.96	7.16	9.85	1	6.43	2.39	3.07	3.55	н
co ₂	32.7	43.6	2.6	43.0	18.3	154	40.2	68.5	6.60	6.98	2.54	32.1	25.8	
5102	867	734	217	532	675	757	559	1073	726	864	009	626	660	
В	69.3	52.0	76.1	49.2	61.3	57.0	53.3	73.0	52.0	64.4	46.9	51.1	48.6	
50_4	28.0	34.7	51.5	32.0	24.9	25.6	30.6	61.5	32.5	36.1	155	39.8	23.2	
C	5788	4308	5424	4361	4773	4965	4617	5993	4436	5262	34.89	4148	3957	
Cs	3,00	11.2	3.22	2.10	2.33	2.31	2.16	3.58	2.81	2.87	1.80	2.15	2.07	
e at SP Rb	4.22	3.56	3.79	5.53	3.17	2.70	2.41	5.31	3.87	4.27	1.77	2.97	2.99	
Water phas Mg	0.13	0.19	0.85	0.36	0.35	0.76	0.42	0.04	0.03	0.05	525	0.06	0.06	
Ca	118	75.5	122	76.0	55.3	63.1	65.6	35.1	31.9	33.6	16.5	4.4	21.4	
К	724	555	634	457	144	497	124	025	055	636	393	157	st	(S. S.)
εŅ	3161	2550	3167	2352	2472	2500	2965	3347	11.52	1177	06.61	05.4	318	rs (H.S.)
17	14.5	17.4	0.41	10.7	10.1	10.2	10.01	(.71	11.6	14.3	6.45	10.7	10.4	Al Sulfid
pH/25 C	6.97	7.43	6.69	6.70	5.95	6.01	6.71	20.7	6.60	7.45	5.20	7.30	16.4	It'S tot
SP bars abs.	9.30	4.52	2.59	11.00	11.50	4.50	6.60	1.00	11.10	1.00	1.00	6.20		
SP NH3	6	26.0	17.0	56.7	69.0	23.0	43.5	11.90	9.59	,	i	26.0	25.0	
phase at H ₂ S	695.7	493.5	165.9	435.3	646.3	317.9	327.5	356.3	204.4	199.5	1109.0	154.4	199.6	(1/kn)
Steam CO2	34.296	21.599	2079	567.18	23.082	23.293	19.154	10,505	12.735	11.450	10.215	3440	169.41	halosfin k
SP hars abs	9.30	4.52	2.59	11.00	11.50	4,50	6.60	9.30	11.10	7.02	2.00	6.20	9.20	charac cat
H K#/Kq	1326	1256	1313	1059	1202	1152	1024	, ;;	1263	1269	1046	2415	1250	ured ats
\$611 104	11-2-30	06~30	001-NO	061-30	05 111d	04119	0/1114	01,-5	0-MD		0101	Sturf	Su-32	H more
	-													

H resured discharge enthalps(in Kj/Kq)

--- andivers not available

CO_y fotal curbunates (HCO $_5$, CO $_3$ $^-$, H $_3$ CO $_3$) reported as CO $_2$ S# semiling pressurvils hars absolute)



Figure 6 Typical variation with time of chemically calculated temperatures, deep water enthalpy, deep water chloride, and CO₂ and H₂S in total discharge of a production well (OK-9D).

1) Two production zones are deduced from the variation of total discharge chemistry in response to differing wellhead pressures, namely, a deep, highly saline fluid containing typically 3,900 ppm of chloride at a mean temperature of 280°C (T Na/K), and a less mineralized but gas rich fluid at shallower levels. variations with time and changing wellhead pressures are interpreted as an intermittent contribution from the upper feed zone (Jordan, 1981b,c, Clemente, 1982a,b). This also attributes to the wellhead pressure cycling that was noted in wells OK-5 and N3 (Camales 1979). This deduction is supported by fluid losses during completion testing and the temperature and pressure logs at flowing conditions, where at least two producing horizons are recognized. The top and bottom of these exploitable zones are believed to be at 300m bsl and 2600m bsl with mean temperatures of 230°C and 320°C respectively (KRTA 1981).

2) The Puhagan wells intercept the least diluted fluid, whereas the Nasuji and Sogongon fluid chemistry has been shown to be modified by dilution with cooler fluid, and oxidation with oxygen containing meteoric water. A common reservoir, however has been consistently indicated by the uniformity of alkali metal ratios, and the chloride to boron equivalence (Jordan, 1981,b,c).

3) The iso-chemical and isothermal contours (Harper and Clemente, 1982) suggest a narrow flow of thermal fluids to the northeast of Puhagan, where the contours close into the Okoy valley. This could be directly associated to a structural control of the Ticala fault which may confine the outflow in a narrow, northeasterly direction. A broad flow to the west through Nasuji and further into Sogongon is also evident, since the contours show a broader extension. This could be due to secondary permeability by thermal cracking, and not directly associated with faulting.

4) The main upflow zone which is postulated to lie beneath the Cuernos volcano, could probably be in temperatures of greater than 300°C. This was estimated by extrapolation of plots of deep chloride versus silica calculated temperatures (Harper and Clemente, 1982, Jordan, 1981 b,c).

3 SOLUTION-MINERAL EQUILIBRIA

3.1 Introduction

The study of solute/mineral equilibria has been shown to be one of the valuable aides in the overall geochemical evaluation of a geothermal system. This is based on the fact that fluid chemistry is primarily governed by the solubility of minerals, and thus an understanding of the thermodynamic factors which affect such equilibria is necessary for the proper interpretation of chemical data. The use of chemical geothermometers, and prediction of mineral scaling and deposition tendencies, for example, are shown to be very dependent on the saturation state that has been attained between rock and fluid.

Previous geochemical studies in the S-Negros Field, have mainly been focused on describing individual wells and field models. Only a limited attention has been given to a quantitative evaluation of the solute-mineral equilibria. It is the objective of this report to attempt such an evaluation investigation, and furthermore, to:

- evaluate the implications of solution mineral equilibria on the applicability and limitations of previous and current chemical geothermometers,
- (2) anticipate mineral deposition tendencies, and,
- (3) predict physical processes (dilution, conductive cooling, precipitation) across the geothermal field.

3.1.1 Applications of solute-mineral equilibria studies

Previous workers, (Fournier 1977; Ellis and Mahon, 1977; Arnorsson, et al. 1982b) have demonstrated that most high temperature geothermal waters attain an overall equilibrium between solutes and alteration minerals. It is known that chemical species is controlled by mineral solubility i.e. Si0, is controlled by the solubility of quartz and chalcedony, Na and K by sodium and potassium feldspars, calcium by calcite and calcium aluminum silicates, and sulfate by anhydrite and iron minerals. The state of saturation, however, is highly dependent on the physical processes which occur during the transport of the fluid from the reservoir to the surface. Intensive studies have shown (Arnorsson et al., 1982 b), that boiling, cooling, degassing, dilution with cooler fluid and the kinetics of water-rock interactions, are the major processes which cause some minerals to deviate from the original saturation state. First level boiling with maximum degassing, for example, has been shown to produce a supersatutated fluid with respect to calcite, and, progressive boiling and cooling to significantly lower temperatures yields amorphous silica saturated fluids, (Ellis and Mahon, 1977; Arnorsson, 1981). It is thus, highly desirable for the proper interpretation of chemical data, that such factors be taken into consideration.

The use of chemical geothermometers predicting in underground temperatures is based on the assumption that equilibrium between fluid and a particular mineral has been and that re-equilibration during conductive attained, Many different chemical cooling is insignificant. geothermometers have been used to estimate reservoir temperatures, among these are silica (Mahon, 1966), Na/K Ellis and Mahon, 1977; White, 1970; (White 1965; Truesdell, 1976a; Fournier, 1979a; Arnorsson et al. 1982 c) and Na-K-Ca (Fournier and Truesdell, 1973). They are based on the experimentally determined solubility of quartz and the variation of Na^+ and K^+ in natural geothermal The waters as a function of temperature. Na-K-Ca geothermometer was developed to deal with calcium rich waters that give anomalously high results when using the Na/K geothermometers, and is empirically calibrated.

It is important to consider the sensitivity of each chemical species (that is used as a temperature function), to physical and chemical changes accompanying the passage of fluid from the reservoir to the surface sampling point. The equilibria governing sodium and potassium feldspars are least affected by cooling, and the use of the ratios of sodium to potassium eliminates boiling and dilution effects, and hence, temperatures estimated from these geothermometers would tend to be higher than those of quartz. The quartz geothermometer, on the other hand, uses directly absolute concentrations of total silica, and would thus readily be affected by dilution. Furthermore, the equilibrium governing quartz and silica is more sensitive to conductive cooling and boiling and generally yields conservative values. Arnorsson et al.(1982 c) showed that the rate of quartz precipitation is positively related to water salinity. The rate of re-equilibration upon cooling between quartz, feldspar and solution is about the same for dilute solutions (1,000 ppm) for water temperatures of about 250°C (Namafjall, NE- Iceland Arnorsson, 1977). For waters of high salinity (13,000 ppm, Svartsengi SW-Iceland), conductive cooling by 10-20°C is fully detected by the quartz geothermometer, but not in the case of Na/K geothermometer.

The Na-K-Ca geothermometer is empirically calibrated involving the addititon of two temperature dependent ratios $(Na^+/K^+ \text{ and } Ca^{++}/Na^+)$. This geothermometer however, (unlike quartz and Na-K) is not in any way related to a specific mineral assemblage and the major reason why it works in some cases is that the free energy that is involved in the dissolution of a particular mineral and the formation of new ones are negligible so that no significant change in water composition is detectable. Furthermore, the work of Arnorsson et al.(1982 c) shows a larger scatter of data points for the ratio Ca^{++}/Na^+ than for Na^+/K^+ indicating that the scatter could be due to equilibrium with more than one mineral assemblage, whereas Na^+ and K^+ activities seem to be governed by equilibrium between low-albite and microline

over the whole temperature range. This makes the Na-K-Ca geothermometer inferior to the Na/K geothermometer whatever calibration curve or beta value is used.

Temperature estimates of the Na-K-Ca geothermometer are more conservative than those of the Na-K geothermometer since large monovalent cations take a long time to equilibrate, whereas divalent, trivalent, and smaller ions Hence, the Ca⁺⁺/Na⁺ re-equilibrate more rapidly. would respond faster to cooling than the Na/K ratio. Another limitation to the application of the Na-K-Ca geothermometer is the precipitation of the calcium ion in significant amounts, especially in zones of intense boiling. This would then result in anomalously high calculated temperatures (Arnorsson et al.1982 c).

Gas geothermometers have also been used, (Ellis, 1979; D'Amore and Panichi, 1980) which involves the temperature dependence of gas-gas equilibria and the relative concentrations of CO₂, H₂S, H₂, and CH₄ in geothermal The calibration is empirical and shown to be steam. in a reasonable agreement with measured temperatures from nearby drillholes. However, re-equilibration between gases during upflow to the surface, has not been duly considered. The apparent discrepancy in temperature values obtained by various geothermometers thus often aid in identifying processes, such as:

- a) dilution with cooler fluid,
- b) conductive cooling,
- c) precipitation and/or deposition along upflow zones accompanying boiling.

It is obvious that although several calibration curves are used in deriving temperature functions for chemical geothermometers, the most common practice in its use is three-fold, namely:

- Complexing between solutes is ignored and analytical concentrations are assumed to represent activities.
- (2) Solubility measurements are mainly done at 25°C and just extrapolated to higher temperatues; effects of fluid pressure on mineral solubility is regarded insignificant, and,
- (3) For gas geothermometers, effects of re-equilibration between various gases has been neglected.

The first case may be true for dilute solutions (<3,000 ppm chloride), but in most geothermal fields, where salinity is a significant factor, e.g. Reykjanes, Iceland (32,000 ppm Cl), Tongonan, Philippines (13,000- 18,000 ppm Cl), Salton Sea, California (33,000 ppm Cl), this assumption often gives misleading results. Arnorsson, et al. (1982 c) demonstrate that temperatures calculated for waters of high salinity and high sulfate from analytical sodium and potassium values, do indeed deviate more significantly from measured temperatures, than those from computed activities. In the second case, Ragnarsdottir and Walther (1982) demonstrated in their quartz solubility measurements at 250°C and 250, 500, and 1000 bars that pressure poses a significant effect on the silica concentrations especially at pressures above 500 bars. These experiments, together with previously reported quartz solubility measurements, yielded a "pressure sensitive silica geothermometer" that takes into account the effect of fluid pressure on the solubility of quartz. The temperature obtained from this geothermometer shows best agreement with measured temperatures in many different geothermal areas (e.g. in Iceland and Kenya) and as will be discussed in the preceding chapters, in S-Negros, Philippines.

Experience, however, shows that fluid pressure in geothermal wells does not reach as high as 350 bars and the main reason why this geothermometer seems to show best agreement with measured temperatures is that the solubility

measurements are done at 250°C, which represents close to actual reservoir conditions, whereas the other quartz solubility measurements are done at 25°C and just extrapolated to higher temperatures.

For the gas geothermometers, Arnorsson et al.(1982 c) showed that gas-steam geothermometers are better than gas-reaction geothermometers since boiling and reaction with rock have less effect on the gas-steam ratios than on the gas-gas ratios. Furthermore, the previous gas geothermometers, which involve H₂, H₂S, and CH₄, are not known to be controlled by any mineral assemblages. The CO₂ gas geothermometer, proposed by Arnorsson et al.(1982 c), to is believed be controlled by the zoisite-epidote-phrenite-quartz-calcite assemblage and this assemblage has been found in many geothermal systems (Browne, 1978).

Arnorsson et al. (1982 b) demonstrated that the ratios of aNa^+/aH^+ , aK^+/aH^+ , $\sqrt{aCa^{++}}/aH^+$, $\sqrt{aMg^{++}}/aH^+$, and acid molecules e.g. H₂CO₃, H₂SO₄ , H₂S, HF, H₄SiO₄ are always fixed at a particular temperature, provided equilibrium has been obtained between rock and fluid. This known relation enabled the derivation of empirical equations which relate the ratios and concentrations of acid molecules to fluid These temperature functions combined with temperatures. other solubility curves of certain minerals (e.g. anhydrite, quartz, calcite, for this study) would aid in precise determinations of whether or not equilibrium has attained between rock and fluid. This would been furthermore check the reliability of the use of chemical and would help in evaluating what geothermometers, processes could be responsible for non-attainment of equilibrium, e.g. mixing, precipitation, etc.

An attempt to apply such an empirically derived relation will be made on the S-Negros field in this report. It is believed to be applicable to define water composition in other areas for two reasons:

- Free energies accompanying hydrothermal reactions are too small to be detected in water chemistry,
- (2) Variations in alteration mineralogy at elevated temperatures are not significant in volcanic rocks ranging from basaltic to rhyolitic compositions, Browne (1978).

Mineral deposition, corrossion, and scaling can cause a major constraint in the exploitation of geothermal fields. The most common scales are calcite, aragonite, amorphous silica, and iron oxides. Depostion is directly associated with temperature dependent mineral/solute equilibria controlling water chemistry. Mineral deposition, as a rule, occurs when the fluid attains a supersaturated state with a particular mineral, which usually follows intensive boiling and cooling. Thus, an understanding of how particularly troublesome minerals deviate from equilibrium in response to physical changes is highly desirable in order to anticipate and controll scaling problems. As will be discussed in later sections, a computer simulation of cooling, boiling and degassing was used to follow mineral saturation states in response to the above mentioned processes.

3.1.2 Mineral saturation state of the deep fluid

Figures 7, 8 and 12a show the state of anhydrite, calcite, and quartz saturation of the deep water, with reference to the measured temperatures at the main production zone. The solublity values for each was calculated from the thermodynamic data of Helgeson (1969), and Helgeson et al. (1978), and the activities of the species from analytical values, using a computer programme described by Arnorsson et al.(1982 a). The saturation state of each mineral is expressed as:

> Log K anhydrite = $aCa^{++} * aS0_4^{--}$ Log K calcite = $aCa^{++} * aC0_3^{--}$ Log K quartz = aH_4Si0_4



It is obvious from the figures that anhydrite and quartz saturation has been attained for most wells, only OK-6, OK-8, NJ1D and SG-2 shows slight undersaturation with respect to anhydrite. It is believed that the lower fluid salinity of these wells, caused probably by mixing and dilution, influences the controll of sulfate activity by the reaction, (Arnorsson et al.1982 a).

$$H_2S + 4H_20 = S04^{--} + 2H^+ + 4H_2$$

The equilibrium condition of anhydrite and quartz is not so sensitive to the reference temperature selected or at simulated runs for conditions of no excess enthalpies, since the calculated activities of aqueous H_4SiO_4 , Ca^{++} , SO_4^{--} do not deviate significantly from the solubility curves.

The saturation state with calcite varies from well to well, but it generally seems to be disturbed by mixing with cooler fluid, which is more pronounced within the Nasuji-Sogongon areas. There most of the wells draw production from Calcite undersaturated fluids as shown in Fig. 8. This is supported by previous plots of aquifer chloride versus calculated silica temperatures where wells SG2, SG1 and OK-6 fall on the dilution line (Clemente 1981 a; Jordan 1981 b,c).

In order to determine the deviation from the original equilibrium state of the fluid to cooling, boiling, and degassing, and to anticipate mineral deposition tendencies, a computer simulated approach was used. Figures 9 to 11 show the deviation curves for Log K values of quartz and amorphous silica, calcite, and anhydrite in response to a computer simulation of cooling, boiling, and degassing processes. An arbitrary choice of 9 boiling steps at conditions of maximum degassing and 7 cooling steps were taken to see their respective deviation from the equilibrium curve. The first four boiling steps are selected at close temperature intervals (2°C), since the



Measured temperature (°C)



most intense deviation from original saturation state usually occurs during the first few levels of boiling. The most representative well (OK-7) of the deep fluid was taken for this study since simulation runs from individual wells showed similar characteristic curves.

It is obvious from the figures for calcite and anhydrite that conductive cooling always yields undersaturated fluids in all the temperature range covered. The calcite and anhydrite curves indicate approach to an slight supersaturation during the first four steps of adiabatic boiling, attaining a maximum deviation from equilibrium after 43°C and 18°C adiabatic boiling for calcite and anhydrite, respectively. The rate of change decreases with progressive steam separation until undersaturation is attained. The slight approach to supersaturation with respect to calcite is not, however, regarded as an indication of potential scaling since log K values fall within the anticipated limit of experimental error.

In the case of silica, conductive cooling yields supersaturated fluids with respect to amorphous silica at about 140°C, whereas if waters cool adiabatically, amorphous silica saturation is reached at 186°C. Experience with re-injection of OK-7 waste water at 155°C for several months, however, showed no signs of serious amorphous silica scaling along the re-injection line. This would tend to indicate that other factors still control the extent of deposition apart from attaining supersaturation. Arnorsson (1981) suggests that the degree of degassing, changes in pH from steam loss, the type of flow (turbulent or laminar), and the possible separation of water and steam phases in the aquifer may control the temperature at which amorphous silica saturation is reached. These factors have not been thoroughly taken into consideration in deposition studies at S-Negros. It is anticipated that potential amorphous silica scaling would not occur until below 150°C.

3.1.3 Empirical relation between aqueous species and temperature.

As was discussed in the section 3.1.1, the attainment of an overall equilibrium between solutes and minerals enables an empirical relation to be derived between concentrations of acid molecules, cation to proton ratios, with temperatures in geothermal waters in Iceland. The selection of such components was arbitrary, i.e. some cation to proton ratios or acid molecule concentrations show better correlation than others. A good fit between aCa⁺⁺/aH⁺ and aMg⁺⁺/aH⁺ and temperature was for example noted, but no correlation found for Ca⁺⁺/Mg⁺⁺ and temperatures.

This is partly attributed to the strong temperature dependence of the calculated hydrogen ion activity, which is caused by the variation with temperature of the dissociation constants of weak acids which control water pH. Table 4 summarizes the temperature functions obtained for the various acid molecules and cation to proton ratios.

An attempt was made to apply such empirically derived relation to the S- Negros field. Figures 12 and 13 show plots of log aqueous acid molecules and log cation to proton ratios. The refernce temperatures used are the measured temperatures at the main production zone. The best fit is noted for log H_4SiO_4 and log H_2CO_3 . This indicates that the H4SiO4 and H2CO3 species govern the total silica and carbonate content of the fluids. The empirical relation for H₂S and H₂SO₄, though scattered, show a closer fit for the Puhagan than the Nasuji and Sogongon wells, which suggests that the Puhagan area is within a better proximity of the reservoir. Log H₂S and log H₂SO₄ show a larger deviation from equilibria and lower cation to proton ratios for most of the Nasuji and Sogongon wells. It is believed that the scatter of hydrogen sulfide could be due to the interim loss of this gas from the solution if much conductive cooling and oxidation occurs during the fluid flow from the reservoir to the surface.
Equations for temperature dependence of log acid molecules and log cation to proton ratios(after Arnorsson et al.,1982 b)

Species/ion rati	io Temperature function	LogK dev mean /st	iation andard
Log H ₄ SiO ₄	-0.588-0.00441T-1515.21/T+1.3470logT	0.06	0.05
Log H ₂ CO ₃	-1.794-0.00510T-4469.63/T+4.1414logT	0.30	0.26
Log H ₂ S	-1.678-0.00355T-5071.05/T+3.8889logT	0.36	0.33
Log H ₂ S0 ₄	-6.436-0.03906T-13335.68/T+14.7958logT	0.57	0.48
Log aNa+/aH+	2.694+0.02023T+4243.47/T-6.2069logT	0.14	0.12
Log aK+/aH+	2.505+0.01971T+3325.71/T-5.7814logT	0.12	0.09
Log aCa ⁺⁺ /aH ⁺	1.733+0.01117T+3890.51/T-3.9977logT	0.17	0.12
Log aMg ⁺⁺ /aH ⁺	1.816+0.01078T+3727.48/T-4.1640logT	0.34	0.27



Figure 12 (a) $\text{Log } H_4 \text{SiO}_4$ vs. measured temperatures (c) $\text{Log } H_2 \text{S}$ vs. measured temperatures (b) $\text{Log } H_2 \text{CO}_3$ vs. measured temperatures (d) $\text{Log } H_2 \text{SO}_4$ vs. measured temperatures



Figure 13 (a) Log aNa^+/aH^+ vs. measured temperatures (c) Log aCa^{++}/H^+ vs. measured temperatures (b) Log aK^+/aH^+ vs. measured temperatures (d) Log aMg^{++}/aH^+ vs. measured temperatures

The rather low cation/proton ratios could readily be sensitivity of the hydrogen ion attributed to the activities to boiling and degassing mechanisms which then have a large effect on the cation to proton ratios. Computer runs at Na-K reference temperatures and at conditions of no excess enthalpy do not in any way give a better fit with the calibration curves. This may indicate that significant mineral re-equilibration due to the presence of excess steam is not responsible for the low cation to proton ratio. It is, however, evident that no equilibrium has been attained between the fluid and the respective species and ratios. Two reasons are suggested:

- (1) Figures 13a-13d indicates that to attain a better fit with the equilibrium curve would require more leaching of cations from the rock. Apparently, leaching rates are not sufficiently high.
- (2) Dilution and mixing with cooler fluid could readily decrease cation concentrations and affect the H⁺ concentrations. A mixing model is attempted in section 3.2.4..

3.2 Geothermometry

Table 5 shows the equations, temperature range, and source of the various chemical geothermometers that will be considered in this study. Table 6 shows chemically calculated and measured temperatures of the deep fluids of the production wells in S-Negros, and Table 7 shows the deviations of the calculated temperatures from measured values.

3.2.1 Quartz geothermometry

Since the pH of the separated waters are all below 8.5, the total silica as analyzed can be taken to represent the H_4SiO_4 fraction. This approximation, however, is not valid when the water pH approaches 9, since a significant

Table showing equations of various chemical geothermometers used to compare with the measured temp. of main production zone at S-Negros (legend for Table 6)

Geothermometer	Range (^C)	Source
(1.) $I(C) = \frac{1309}{5.19 - \log 102} - 273.15$	0 - 250	Fournier(1977), SiO ₂ in mg/Kg of the deep water;assumes no steam loss
(2.) I(C) $\frac{1164}{4.90 - \log 510_2} - 273.15$	180 - 300	Arnorsson et al.(1982 c); SiO ₂ in mg/Kg of the deep water; assumes no steam loss
(3.) I(C) 771 - (336 - 0.017P)*LogmSi(OH) ₄ *2H ₂ O - 35.8(log mSi(OH) ₄ *2H ₂ O) ²	180 - 340	Ragnarsdottir and Walther(1982); SiO ₂ in moles per liter at 1atm; P – fluid pressure in bars.
(4.) I(C) <u>1647</u> log Na/K + Blog Ca/Na + 2.24 - 273.15	4 - 340	Fournier-Truesdell(1973);B=1/3 for Ca/Na < 1 and T > 100 °C; Na, K, Ca in moles per liter
(5.) I(C) $\frac{1217}{\log Na/K + 1.483} = 273.15$	100 - 300	Fournier(1979); Na,K in mg/Kg
(6.) I(C) $\frac{933}{\log Ma/K + 0.993} - 273.15$	25 - 250	Arnorsson et al.(1982 c); Na,K in mg/Kg
(7.) I(C) $\frac{1319}{1.699 + \log Ia/K} = 273.15$	250 - 350	Arnorsson et al.(1982 c); Na,K in mg/Kg
(5,) Log Na/K -1.752 - 2775.5/T - 558780/T2 -0.00964T - 4.104logT	25 - 350	Arnorsson et al.(1982 c): Na,K in moles/Kg, T in 'K
(9.) Log CO ₂ 37.43 - 73192/I -11529000/T2 0.15923I - 86.1571ogI	150 - 300	Arnorsson et al.(1982 c); CO2 in moles/Kg steam at 1atm; T in [°] K

* Chemically calculated and measured temperatures at the main production zone in S-Negros

				Tem	peratur	es(°C)				
Well No.	Meas.	Q	uartz		Na-K-Ca		Na	/ K		C02
		1)	2)	3)	4)	5)a	6)a	7)a	8)b	9)
0К-7	318	(264)	269	295	280	300		291	309	296
OK-9D	291	(252)	256	273	276	293		284	289	290
0K-10D	259	(256)	260	268	269	287		277	277	270
0K-12D	250	243	245	253	265	281		274	273	289
PN13D	268	(260)	265	272	281	297		288	289	286
PN15D	274	(262)	266	276	265	272		265	265	290
PN17D	245	244	247	253	249	249	234		238	284
0K-5	264	(288)	297	298	304	308		298	299	278
0K-6	285	(261)	266	279	279	284		276	279	276
0K-8	244	(273)	279	279	294	300		291	290	276
NJ1D	243	239	241	249	284	287		279	276	278
5G-1	277	246	248	263	278	286		278	280	271
5G-2	275	(254)	258	269	292	298		289	291	280

* For description of chemical geothermometers, see Table 5 a Na/K ratio from Na,K analyzed b Na/K ratio from calculated Na⁺,K⁺ activities Figures in brackets indicates extrapolated values

Table showing mean and standard deviations of chemically calculated temperatures from measured temperatures at main production zones in S-Negros

Well		Quartz		Na-K-Ca		N	a/K		C02
NO.	1)	2)	3)	4)	5)a	6)a	7)a	8)b	9)
0K-7	-54	-49	-23	-38	-18	-	-27	-9	-22
0K-9D	-39	-35	-18	-15	+2	-	-7	-2	-1
0K-10D	- 3	+ 1	+9	+10	+28	-	+18	+18	+11
0K-12D	- 7	- 5	+ 3	+15	+31	-	+24	+23	+39
PN13D	- 8	- 3	+4	+13	+29		+20	+21	+18
PN15D	-12	- 8	+2	-9	-2	-	-9	-9	+16
PN17D	- 1	+2	+8	+5	+4	-11	0	-7	+39
0K-5	+24	+33	+34	+40	+44	-	+34	+35	+14
0K-6	-24	-19	-6	-6	- 1	-	-9	-6	-9
0K-8	+29	+35	+35	+50	+56	2 <u>-</u>	+47	+46	+32
NJ1D	-4	-2	+6	+41	+44	-	+36	+33	+ 35
SG-1	-31	-29	-14	+ 1	+9	-	+1	+ 3	-6
SG-2	-21	-17	-6	+15	+23	-	+14	+16	+5
Mean							10-14-142		
dev.(°C)	19.8	18.3	12.9	19.8	22.4	-	18.9	17.5	19.0
M(%)	7.31	6.69	4.72	7.21	8.09	-	6.90	6.46	7.01
9(%)	5.63	5.78	4.10	5.90	6.73	-	5.30	5.11	5.06

+ Sign refers to degrees C higher than measured temperatures

- Sign refers to degrees C lower than measured temperatures

M mean percent deviation

o standard deviation

fraction of the total silica exists as H_3SiO_4 , which does not participate in the equilibria with quartz. The various quartz geothermometers (Fournier, 1977; Arnorsson et al., 1982 c) presented in Table 5 assumes no steam loss and are calculated from the deep water silica. The "pressure sensitive silica geothermometer" of Ragnarsdottir and Walther (1982) is calculated from silica concentrations at atmospheric pressure and from the fluid pressure at the depth of inflow. The silica concentrations at sampling pressures were recalculated to 1 atm assuming single stage adiabatic boiling.

The silica geothermometers of Fournier (1977) and Arnorsson et al. (1982 c) generally gives lower values than measured for most wells. This suggests silica being precipitated (probably within the liner and casing walls) at depth due to its relatively fast rate of re-equilibration which could be enhanced by fluid salinity, as readily shown in the high chloride wells OK-7 and OK-9D where the calculated silica geothermometers are lower than measured by 35°C to 45°C. Similarly the lower values of the geothermometers may indicate dilution with cooler fluid which was previously shown to be more pronounced in the Nasuji and Sogongon sector of the field. The quartz geothermometers, on the average, give 19°C lower than measured temperatures for wells SG-2, and SG-1.

The "pressure sensitive silica geothermometer" of Ragnarsdottir and Walther (1982) yields the least average deviations from the measured values (12.9 °C). The average deviations of the quartz geothermometers of Fournier (1977) and Arnorsson et al. (1982 c) are 19.8 °C and 18.3 °C, respectively.

3.2.2 Cation geothermometry

Tables 6 and 7 show that the Na/K geothermometer, on the average, yields temperatures which are higher than measured. The Na-K-Ca geothermometer gives slightly lower

temperatures than the Na-K which can be attributed to the fact that the function Ca/Na is more sensitive to cooling than the Na-K ratio. The above trend could also imply that higher temperatures could still exist, probably greater than 300°C.

The calibration curves of Arnorsson et al. (1982 c) for the Na-K geothermometer are based on low albite-microline data from Helgeson (1969) and calibrated empirically using analytical values for Na+ and K+ on one hand and computed activities on the other. When applied to the S-Negros data the calibration curves show a temperature difference of more than 2°C for almost half of the samples, particularly in the more saline Puhagan fluids. The high salinity and high temperature of the fluid could cause the analytical ratios of Na/K to deviate significantly from the Na⁺/K⁺ activity ratio due to the higher degree of complexing of sodium to form NaCl species. The use of the Na⁺/K⁺ activity ratio, which cancels out the complexing process, is regarded the most reliable geothermometer to estimate subsurface temperatures in the S-Negros geothermal field. Well NJ1D, which shows exceptionally high sulfate (155 ppm) is the only Nasuji well whose Na/K temperature as calculated from analytical concentrations and computed activities differ by as much as 5°C. The high sulfate content of the fluid could give higher stability to the KSO4 complex relative to NaSO4, which yields high temperatures when analytical concentrations are used instead of activities, (Arnorsson et al.1982 c).

Arnorsson et al.(1982 c) empirically calibrated the Na/K geothermometer using the computed activities of Na⁺ and K⁺ and showed this geothermometer to have the least deviation among cation geothermometers. The significant differences between the Na-K temperatures from quartz temperatures supports the concept of precipitation of quartz in saline fluids and dilution with cooler fluid for less saline waters.

3.2.3 CO2 geothermometry

Arnorsson et al. (1982 c) proposed an empirical CO_2 geothermometer based on data from deep drillholes in Iceland, which is applicable in the temperature range 180-300°C. The lower limit is set by the effect of the salinity of the parent water on the CO_2 concentrations in the steam, while the upper limit is set by the mobility of the gas at higher temperatures.

CO2 concentrations in steam at sampling pressure was recalculated to 1 atmosphere assuming adiabatic boiling in one stage. Tables 6 and 7 show that the calculated temperatures gave generally higher values than measured by about 19°C which provides evidence for higher temperatures elsewhere, as was also concluded for the Na/K geothermometers.

3.2.4 Chloride-enthalpy mixing models

The following factors which have been described earlier might be explained by mixing: a) the discrepancies between the quartz and the Na/K geothermometers, b) non-attainment of overall equilibrium between certain species and cation to proton ratios, and c) linear relationship between silica and chloride.

The chloride-enthalpy mixing model was utilized to test the hypothesis that cold meteoric water recharge from the northwest is the diluting component of the discharges in the Sogongon and some Nasuji wells, and to estimate the temperature of the hot water component. Fig. 14 shows the chloride concentrations plotted against the deep water enthalpy. The deep water enthalpy was taken from the silica calculated temperatures of Ragnarsdottir and Walther (1982), which gave the least deviation from measured values. Deep water chloride values were calculated from analytical results at sampling pressure to the measured



temperatures at the main production zones, after appropriate corrections for excess enthalpies had been made.

Following the procedure described by Fournier (1977), assuming minimal heat gain or loss after mixing, extrapolation of the best fit line (dilution line) yields maximum and minimum temperatures of the hot water component to be 310-300°C. This is slightly lower than the maximum measured bottomhole temperatures of some wells (318°C OK-7, 322°C OK-9D, 317°C PN-13D, 310°C OK-5) and reveals that the hottest wells are still withdrawing from a mixed fluid, but with a significantly lower fraction of the cooling component. Fig. 14 indicates that the diluting component has a negligible chloride content (indicative of meteoric water) yet has an enthalpy of 520 KJ/Kg which corresponds to a liquid water saturation temperature of 120°C. This suggests either a) cold meteoric water picking up heat from the rock before mixing with the hydrothermal fluid, or b) Steam heated ground water rich in carbonate and sulfate. From the absolute sulfate, carbonate, and pH of the discharges of SG-1, SG-2, OK-6, NJ1D, however, cause a) is more likely.

The slightly lower enthalpy yet relatively high chloride of contents of wells OK-8, PN-13D, PN17D, OK-10D, and OK-12D are indicative of conductive cooling. Points designated as X1-X7 would represent variations in enthalpy and chloride contents of the liquid water fraction during progressive steam separation. The use of the above mixing model is believed to give more reliable temperatures that the silica-enthalpy plot since the temperature of the hot water component is close to 300 °C (Fournier, 1977).

3.3 Isochemical and isothermal contours

In order to visualize the pattern of temperature distribution, to predict further areas for drilling priorities, and to determine the extent of the reservoir, selected chemical geothermometers and species were plotted across the field and compared with the isothermal contours at 1000m depth. The isothermal contours were deduced from the estimated stable rock temperatures which were taken after a careful examination and selection of all downhole temperature logs, (Catigtig and Amistoso, 1981). Figures 15-17 show plots of iso T aNa⁺/aK⁺, iso T Si(OH)₄*2H₂O, and iso-chloride. Figure 18 shows the isothermal plots at 1000m depth.

The isochemical contours, more or less, shows a series of broad concentric rings towards the north and west, but exhibit a definite sharpening and distortion within the vicinity of the Puhagan wells. This sharpening trend seems to be dirctly associated with the Ticala fault (Harper and Clemente, 1982), which confines the flow in a narrow northeasterly direction.

The inherent low temperature and low permeability of well OK-11D results in a similar narrow contour stretch between the bottomholes of OK-5, and OK-9D, and further indicates the flow from an upwelling fluid is initially that restricted within these areas, but then broadens outwards to the west into Nasuji, and progressively into Sogongon. The present author, however, suggests that indications of a broad flow within this vicinity cannot be presented with reasonable certainty. Connection of contour lines between the widely spaced wells (OK-6 to SG-1 and 2, to OK-8) must be treated with extreme caution. It is evident from the plots that an outflow zone is located near wells SG-1, SG-2, and OK-12D. In this area differnces in absolute chemistry from the rest of the wells indicate the flow regime to be slow and indulgent in continued water-rock reaction during conductive cooling and/or dilution with cooler fluid.

The difference in absolute values between T $Si(0H)_4 2H_2 0$ and T aNa^+/K^+ is significant in the Sogongon wells(32-33°C) and some Nasuji wells, (OK-6 13°C, NJ1D 35°C), indicative of



a 1

Figure 15. Iso $T_{Si(0H)_4} 2H_20$ map of the Palinpinon field.



Figure 16. Iso $T_{aNa}^+/_{aK}^+$ map of the Palinpinon field.



Figure 17. Iso chloride map of the Palinpinon field.



Figure 18 Isotherms at 1000m bmsl of the Palinpinon field.

mixing. This is readily supported by the iso chloride contours (Fig. 17) which show a definite dilution trend, increasing in magnitude from east to west. The absolute deep water chloride values of wells SG-1 and 2, OK-6 and NJ1D are lower (3000-3360 ppm), than the Puhagan wells (3400-3950 ppm). All contours point to the Cuernos volcano as the ultimate heat source of the field, beneath which the upwelling zone is postulated to be at temperatures of over 300°C.

3.4 CONCLUSIONS

a) The complex and iterative calculations involved in the interpretation of the chemical data from the production wells in SNGF made the use of a computer programme necessary.

b) Anhydrite and quartz are shown to be in equilibrium with the deep water for most wells. Calcite saturation, however, appears to be controlled by temperature and affected by mixing with cooler fluid. Potential calcite deposition is not likely to occur, but amorphous silica scaling could be a problem below 150°C reinjection or production separation temperature.

c) The empirically derived relation between aqueous species and temperature, Arnorsson et al.(1982 b) compares well for the silica and bicarbonate species; but the low cation to proton ratios could be due to a different rock leaching property and the effects of dilution with extranneous fluids.

d) For S-Negros fluids, the "pressure sensitive silica geothermometer" of Ragnarsdottir and Walther (1982), and the Na-K geothermometer of Arnorsson et al. (1982 c) using the computed activities of Na⁺ and K⁺, yield the least deviation from measured values of the various geothermometers tested.

e) Chloride - enthalpy mixing models suggest that cold meteoric water recharge from the northwest picks up heat from the rock before mixing with an outflowing hydrothermal fluid, which explains its high enthalpy yet almost zero chloride content. True reservoir temperatures are estimated to be at least 300 °C.

4.0 RECOMMENDATIONS

The following are recommendations for further geochemical studies based upon the results which have emerged during the evaluation of the chemical data presented in this report:

(a) A representative sample from each well should be analyzed for iron, aluminum, and flouride. Most of the minerals found in SNGF contain these elements and analysis of these elements therefore would allow more solute/mineral equilibria studies.

(b) To facilitate and speed up studies of mineral deposition and scaling, a computer programme such as that developed in Iceland should be utilized. This is highly relevant considering the accelerated discharge testing of wells and especially for the programmed reinjection wells in SNGF.

(c) The use of gas geothermometers should be given equal attention to that of the quartz and the cation geothermometers. This could much aid in predicting subsurface temperatures and in identifying flow processes in the field, especially in areas where intense steaming grounds are located, e.g. Kaipohan and Baslay de Dauin.

(d) Variations of chemistry with time, especially for wells on long term discharge tests, should be examined carefully to detect the response of the reservoir to exploitation. This may be detectable only after years of continous discharge.

(e) A revision of certain aspects in sampling procedures and analytical methods are still necessary. For more details of this recommendation, see manual on methods of collection and analysis of geothermal fluids by the Virkir Consulting Group Ltd.

ACKNOWLEDGEMENTS

The author wishes to express his thanks and appreciation to the 1982 UNU organizers of Geothermal the Training Programme under the direction of Dr. Ingvar Birgir Fridleifsson, for such an excellent organization of the course which had greatly enriched the knowledge of the The author thanks the UN author in geothermal science. Fellowship, the PNOC-EDC University for the and geoscientific department, thru Mr. Bernie S. Tolentino for giving all the support in making the participation in the training possible. Special thanks go to his main supervisors, Dr. Einar Gunnlaugsson of the Reykjavik Municipal Heating Service and Dr. Stefan Arnorsson, of the Science Institue, University of Iceland, for their much useful and enriching teaching of geochemistry and for their guidance, constructive criticisms and suggestions to the final preparation of this report. The basic chemical data used in this research project is a joint effort of the EDC KRTA geochemical units, and this is acknowleged. To and Dr. Halldor Armansson, Mr. Gestur Gislason, and Mr. Jon Benjaminsson for their guidance in the field sampling training at the Krafla geothermal field. To Dr. Jon Orn Bjarnsson for his patience in assisting in the computer methods while the author kept on stumbling through its rudiments. To the Orkustofnun drawing office for excellent reproduction of figures. Lastly, the author expresses his Mr. Sigurjon Asbjornsson for thanks to the special innumerable assistance he has given to all the UNU Fellows during the whole training period.

62

.

REFERENCES

- Arnorsson, S. (1977): Changes in the Water and Steam Discharged From Wells in the Namafjall Geothermal Field, Iceland, During the Period 1970–76. Jokull, v. 27, 50–55.
- Arnorsson, S. (1981): Mineral Deposition From Icelandic Geothermal Waters: Environmental and Utilization Problems. Journal of Petroleum Technology, 182-186.
- Arnorsson, S., Sigurdsson, S., Svavarsson, H. (1982 a): The Chemistry of Geothermal Waters in Iceland I. Calculation of Aqueous Speciation From 0°C to 370°C. Geochim. Cosmochim. Acta, in press, 31-34.
- Arnorsson, S., Gunnlaugsson, E., Svavarsson, H. (1982 b): The Chemistry of Geothermal Waters in Iceland II. Mineral Equilibria and Independent Variables Controlling Water Compositions. Geochim. Cosmochim Acta, in press, 8–25.
- Arnorsson, S., Gunnlaugsson, E., Svavarsson, H. (1982 c): The Chemistry of Geothermal Waters in Iceland III. Chemical Geothermometry in Geothermal Investigations. Geochim. Cosmochim. Acta, in press, 8-21.
- Bagamasbad, N.G. (1979): The Geology and Alteration Mineralogy of Well OKOY-5 S. Negros, Philippines. UNU Geothermal Training Programme, Iceland, Report 1979-2, 2-5.
- Baltazar, A.J. (1980): Interpretations of the Water and Gas Chemistry From Three Geothermal Areas in the

Philippines -Manito in Albay, Biliran Island, and Tongonan, Leyte. UNU Geothermal Training Programme, Iceland, Report 1980-3, 13-14.

- Barnett, P.R. (1980): Preliminary Report on N-3 Calcining Studies. KRTA memorandum report, 2-3.
- Browne, P.R.L. (1978): Hydrothermal Alteration in Active Geothermal Fields. Ann.Rev. Earth Planet, Sci., v. 6, 229–250.
- Camales, R.A. (1979): Overview of the Okoy Valley Geochemistry, Exploration Wells, and Deep Production wells, Southern Negros. PNOC-EDC internal report, 12–19.
- Catigtig, D.C., Amistoso, A.E. (1981): Okoy Field Temperature Contour Lines. PNOC-EDC internal report, 1-4.
- Clemente, V.C. (1982a): Well SG-2 Geochemistry of Medium Term Discharge Test. PNOC-EDC internal report, 2-3.
- Clemente, V.C. (1982 b): Well PN-17D Geochemistry of Medium Term Discharge Test. PNOC-EDC internal report, 2-3.
- D' Amore, F., Panichi, C. (1980): Evaluation of Deep Temperatures of Hydrothermal Systems by a New Gas Geothermometer. Geochim Cosmochim. Acta, v.44, 549–556.
- EDC-KRTA (1982): Okoy Field Measurements Data and Interpretations. Published by D.C. Catigtig, 3.
- Ellis, A.J., Mahon, W.A.J. (1977): Chemistry and Geothermal Systems, Academic Press, New York, 299-301.

- Ellis, A.J. (1979): Chemical Geothermometry in Geothermal Systems. Chem. Geol., v. 25, 219-226.
- Fournier, R.O. (1977): Chemical Geothermometers and Mixing Models For Geothermal Systems. Geothermics, v. 5, 47-49.
- Fournier, R.O., (1979 a): A Revised Equation For the Na/K Geothermometer.Geothermal Resources Council Transactions, v. 3, 221–224.
- Fournier, R.O. (1979 b): Geochemical and Hydrologic Considerations and the Use of Enthalpy-Chloride Diagrams in the Prediction of Underground Temperatures in Hot Spring Systems; J. Volcanol. Geotherm. Res., 5-16.
- Fournier, R.O, and Truesdell, A.H. (1973): An Emperical Na-K-Ca Geothermometer For Natural Waters. Geochim. Cosmochim. Acta, v. 37, 1255–1275.
- Glover, R.B. (1975): Chemical Analysis of Waters From Negros Oriental, Philippines, and their Geothermal Significance, 6-7.
- Harper, R.T., Clemente, V.C. (1982): Nasuji-Sogongon Geochemical Trends. PNOC-EDC internal report, 5-6.
- Helgeson, H.C. (1969): Thermodynamics of Hydrothermal Systems at Elevated Temperatures and Pressures. American Journal of Science, v. 267, 729-804.
- Helgeson, H.C., Delany, J.M., Nesbitt, H.W., and Bird, D.K. (1978): Summary and Critique of the Thermodynamic Properties of Rock-Forming Minerals. Am. Jour. Scie., 278A, 1-229.

- James, R. (1962): Steam-Water Critical Flow Through Pipes: Inst. Mech. Engrs. Proc., v. 176, no. 26, p. 741.
- Jordan, O.T. (1981 a): Well Okoy-7 Geochemistry of Medium Term Discharge Test. PNOC-EDC internal report, 1-5.
- Jordan, O.T. (1981 b): Well Okoy-6 Geochemistry of Long Term Discharge Test. PNOC-EDC internal report, 1-11.
- Jordan, O.T. (1981 c): Well Okoy-9D Geochemistry of Medium Term Discharge Test. PNOC-EDC internal report, 1-9.
- KRTA(1977): Review of Geothermal Potential and Recommendations for Exploration Wells, Okoy 1 - 2, Southern Negros, Philippines, 12-20.
- KRTA(1979): Preliminary Evaluation and Assessment of Results of Stage II Exploration and Drilling of the Okoy Geothermal Field, Southern Negros, with proposed recommendations for Stage III Drilling.
- KRTA(1981): Palinpinon Geothermal Power Project. Stage 1
 Steam Collection System, Preliminary Design
 Report, 6-9.
- Mahon, W.A.J. (1966): Silica in Hot Water Discharged From Drillholes at Wairakei, New Zealand. J. Sci., v. 9, 131-144.
- Obusan, R.O. (1980): Notes on the Isothermal and Isochemical Lines at the Southern Negros Field, PNOC-EDC internal report, 1-3.
- Ragnarsdottir, K.V., Walther, J.V. (1982): Pressure Sensitive " Silica Geothermometer " Determined From Quartz Solubility Measurements at 250°C. Geochim. Cosmochim. Acta, in press.

- Reyes, A.G., Tolentino, B.S. (1981): The Distribution of Alterartion Minerals in Philippine Geothermal Areas. Paper Presented, 1981 ASCOPE meeting, Manila, Philippines, 6-7.
- Ruaya, J.R. (1980): Comments on the Geology and Geochemistry of the Kaipohan Areas, Southern Negros Geothermal Field PNOC-EDC internal report.
- Truesdell, A.H. (1976 a): Summary of Section III. Geochemical Techniques in Exploration. Second United Nations Symposium on the Development of Geothermal Resources, San Francisco, May, 1975, 1,iii-1xiii.
- White, D.E. (1965): Saline Waters of Sedimentary Rocks. Amer. Assoc. Petroleum Geologists, Mem. 4, 352-366.
- White, D.E. (1970): Geochemistry Applied to the Discovery, Evaluation, and Exploitation of Geothermal Energy Resources. Geothermics, Special Issue 2, 1, 58–80.

ORKUSTOFNUN JHD GEOCHEMISTRY OF WELL SONGON-1 1982-11-12 OLIVER S.NEGROS, PHILIPPINES SOGONGON PROGRAM WATCH1. WATER SAMPLE (PPM) STEAM SAMPLE PH/DEG.C 7.30/25.0 GAS (VOL.Z) REFERENCE TEMP. DEGREES C 277.0 (MEASURED) 626,00 C02 0.00 SI02 SAMPLING PRESSURE BARS ABS. NA 2250.00 H2S 0.00 6.9 H2 DISCHARGE ENTHALPY MJOUL/KG 1+222 (MEASURED) 457,00 0.00 ĸ CA 34.40 02 0.00 DISCHARGE KG/SEC. 35.8 MG 0.060 CH4 0.00 MEASURED TEMPERATURE DEGREES C 32.10 N2 0.0 C02 0.00 504 39,80 RESISTIVITY/TEMP+ OHMM/DEG+C 0.0/ 0.0 H2S 3.07 EH/TEMP. MV/DEG.C 0.000/ 0.0 4148.00 CL 0.00 LITERS GAS PER KG F MEASURED DOWNHOLE TEMP. FLUID INFLOW RISS.SOLIDS 0.00 CONDENSATE/BEG.C 5.23/25.0 DEPTH (METERS) **BEGREES C/METERS** AL 0.0000 6 51,1000 0.0 0.0 0.0 FE 0.0000 CONDENSATE (PPM) 0.0 0.0 0.00/ 0.0 0.0 0.0000 PH/DEG.C NH3 0.00 0.0 0.0 0.0 C02 0.0 0.00 0.0 0.0 H2S 0.0 0.00 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 0.0 0.0 C02 9848.70 0.0 0.0 0.0 H2S 154.40 0.0 IONIC STRENGTH = 0.11594 IONIC BALANCE : CATIONS (MOL.EQ.)0.11101650 ANIONS (MOL.EQ.)0.11839960 DIFFERENCE (%) -6.44 GAS PRESSURES (BARS ABS.) DEEP STEAM (PPM) BEEP WATER (PPM) 0.492E+01 2305.96 C02 195879.34 C02 SI02 466+63 C02 H2S H2S 1043.08 H2S 0.338E-01 1677.05 40.53 NA 0.000E+00 0.00 H2 К 340.61 H2 0.00 H2 02 0.00 02 0.000E+00 25+64 82 0.00 CA 0.000E+00 CH4 0.00 CH4 CH4 MG 0.045 0.00 N2 29.66 N2 0.00 N2 0.00 0.000E+00 S04 0.00 NH3 0.000E+00 NH3 0.00 NH3 CL. 3091.47 H20 0.613E+02 F 0.00

TOTAL

0+663E+02

0.0000 AL 0.12 H20 (%) 38,0841 B 0.25 BOILING PORTION FE 0.0000

GAS SOLUBILITY MULTIPLYING FACTOR : 1.00

0.00

DISS.S.

WAIRAKITE

EPIDOTE

-25,119 99,999

-39,107 99,999

5

4

========									
						a i i i i i i i i i i i i i i i i i i i		na man ann ann ann ann ann ann ann ann a	
ACTIVITY	COEFFICIENTS	IN DEEP WATE	R						
H+	0.698	KSD4-	0.639	F	E++	0.179	FFCI 4	0 400	
OH-	0.598	F-	0.598	F	E+++	0.040	A1 +++	0.040	
H3SI04-	0+609	CL-	0.585	F	EOH+	0.631	AL 0H++	0.147	
H2SI04	0.167	NA+	0.609	F	E(OH)3-	0.631	AL (04)21	0 470	
H2B03-	0.572	K+	0.585	F	E(OH)4	0,159		0.401	
HC03-	0.609	CA++	0.179	F	EOH++	0.159		0.401	
CO3	0.148	MG++	0.219	F	E(0H)2+	0.439	AL (CDAVO_	0.021	
HS-	0.598	CAHC03+	0.651	F	E(0H)4-	0.470	ALC100472-	0:021	
S	0+159	MGHC03+	0.609	F	FS044	0.471	MERTT	0+10/	
HS04-	0.621	CAOH+	0.651	5	FCI ++	0.150	ALEA.	0+037	
S04	0.138	MGOH+	0.660	F	EC1 24	A 471	HLCH-	V+021	
NAS04-	0.639	NH4+	0,572	F	FCI A-	001 0	ALC J	0+148	
			V/0/L		he Wile Y	V10V7	HLF 0	0+014	
CHENICAL (COMPONENTS IN	DEEP WATER	PPM AND LOG	KOLE)					
H4 (ACT.)	0.00 -	-5.690	HG44	0.04	-5.700	EE (DU) 7	0 00	A AAA	
OH-	0.13 -	-5,100	NACI	700.01	-2 144	FE(OH)A	0.00	0.000	
H4ST04	745.95	-2.110	KCI	74 14	-2+100	FE(UN)4-	0.00	0.000	
H3ST04-	0.31 -	5 497	NACOA.	07+14	-3+337	FELLT	0.00	0.000	
H2STD4	0.00 -1	0.902	KG04-	0.00	-11200	FECLZ	0.00	0.000	
NAHISTOA	0.19	5 704	CACOA	0./2	-4+190	FECL++	0.00	0.000	
07007	217 70	0 AF7	UA204	2.76	-4.662	FECL2+	0.00	0.000	
10000 100007	21/+/0 -	'Z+933 ⊊ (00	56504	0.02	-6.895	FECL3	0.00	0.000	
H2503~	U+12 ~	3+088	CALU3	0+02	-6+627	FECL4-	0.00	0.000	
HZC03	3213.52 -	1.285	MGCO3	0.00	-10,488	FES04	0.00	0.000	
HCU3~	27,05 -	3.353	CAHC03+	11,58	-3,941	FES04+	0.00	0.000	
C03	0.00 -	8+552	MGHC03+	0.00	-7.597	AL+++	0.00	0.000	
H2S	39+92 -	2.931	CAOH+	0+02	-6.440	ALOH++	0.00	0.000	
HS-	0.59 -	4.751	HG0H+	0.00	-7,190	AL(0H)2+	0.00	0.000	
S	0.00 -1	3,289	NH40H	0.00	0.000	AL(OH)3	0.00	0.000	
H2S04	0.00 -1	0.950	NH4÷	0+00	0.000	AL(0H)4-	0.00	0.000	
HS04-	3.03 -	4.506	FE++	0.00	0.000	ALS04+	0.00	0.000	
S04	13.01 -	3*868	FE+++	0.00	0.000	AL(S04)2-	0.00	0.000	
HF	0.00	0.000	FE0H+	0.00	0.000	ALF++	0.00	0.000	
F	0.00	0.000	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000	
CL-	2833.31 -	1.097	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000	
NAt	1518.83 -	1,180	FE(OH)4	0.00	0.000	ALF4-	0.00	0.000	
K 1	320.18 -	2.087	FE(0H)++	0.00	0.000	ALF5	0.00	0.000	
CA++	20.15 -	3.299	FE(0H)2+	0.00	0.000	ALF6	0.00	0.000	
IONIC STRE	NGTH = 0.07	866 IONI	C BALANCE :	CATIONS	(MOL.EQ.)	0.07537772			
1999-1999-1999-1999-1999-1999-1999-199		aast (2000)2		ANIONS	(MOL.EQ.)	0.08066924			
				DIFFERE	NCE (%)	-6.78			
CHEMICAL G	EOTHERNOMETE	RS DEGREES C		1000/T	DEGREES KEI	VIN = 1.82			
QUARTZ	246.3								
CHALCEDONY	999.9								
NAK	288.3								
1	20010								
OXTRATION I	POTENTIAL (U		FH H29= -0.4	RA EN	CH4= 99,999	FH H2= 99.0	200 EN MR	7= 00,000	
0//12/11/10/11		20107 1		<i>.</i>	wiin- //////	Lii 112" 774.	/// 1.11 1.11	9- 11+111	
I DG SOLLIRT	TTY PROMITTO	OF MINEDALC	TH DEED HAT	50					
200 000001	TCOD	PALC	TH DEFL MAIL	-/)	CALC		7000	CALC	
ADHI ADTA	14 774	00 000	ALDITE LOU	17 04	+ UNLU+	ANALOTHO	11 500	00 000	
AMULANIA	-14+3/4	77+777	HLDITE LUN	-13+79	1 17 101	HRALLINE	-11,379	77 4777	
ANMIERITE	-8,611	-8,//4	CALCITE	-13,48	1 -13+426	CHALCEDON	-1,891	-2,110	
MG-CHLORIT	L -8/,1/5	99,999 99,999	FLOORITE	-11,10	y yy,yyy	GUETHITE	3,805	77.779	
LAUMONTITE	-24,818	99,999	MICKUCLINE	-14,97	/ 99,999	MAGNETITE	-14,275	99,999	
CA-MONTMOR	-72,578	99,999	K-MUNTMOR.	-33,81	4 99,999	MG-MONTMO	K, -74,086	99.999	
NA-MONTMOR	-34,099	99,999	MUSCOVITE	-17,84	2 99,999	PREMNITE	-38,313	99.999	
PYRRHOTITE	-5.596	99,999	PYRITE	-21.87	9 99.999	QUARTZ	-1,996	-2.110	

WOLLASTONITE 7.047

MARCASITE

5.225

-5.949 99.999

ZOISITE

-39,262 99,999

ORKUSTOFNUN JHD GEOCHEMISTRY OF WELL SOGONGON-2 1982-11-12 OLIVER S.NEGROS, PHILIPPINES SOGONGON PROGRAM WATCH1. WATER SAMPLE (PPM) STEAM SAMPLE PH/DEG+C 5+91/2 2002 660+00 REFERENCE TEMP, DEGREES C 275.0 (MEASURED) 5.91/25.0 GAS (VOL.%) 0.00 C02

for all for the	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	for he day		A 4 8 8			
NA	2139.00	H2S		0.00	SAMPLING PRESSUR	E BARS AB	35. 9.2
ĸ	482,00	H2		0.00	DISCHARGE ENTHAL	PY MJOUL/	/KG 1.280 (MEASURED)
CA	21.40	02		0.00	DISCHARGE	KG/SE	C. 14.9
MG	0.060	CH4		0.00			
C02	25,80	N2		0.00	MEASURED TEMPERA	TURE DEGREES	C 0.0
S04	23.20				RESISTIVITY/TEMP	. OHMM/DEG	3.C 0.0/ 0.0
H2S	3.58				EH/TEMP+	MV/DEG	G.C 0.000/ 0.0
CL	3957.00						
F	0.00	LITE	S GAS PER KG				
BISS.SOLII	IS 0.00	COND	ENSATE/DEG.C	7.97/25.0	MEASURED DOWN	HOLE TEMP.	FLUID INFLOW
AL	0.0000	10000000			DEGREES C/	METERS	DEPTH (METERS)
B	48,6000						
FF	0.0000	COND	ENSATE (PPM)		0.0	0.0	0.0
NH3	0.0000	PH/D	EG.C	0.00/ 0.0	0.0	0.0	0.0
in the	COLORIDA.	C02		0.00	0.0	0.0	0.0
		H2S		0.00	0.0	0.0	0.0
		NA		0.00	0.0	0.0	0.0
					0.0	0.0	0.0
					0.0	0.0	0.0
					0.0	0.0	0.0
		COND	INSATE WITH N	ACH (PPM)	0.0	0.0	0.0
		C02	146	90.90	0.0	0.0	0.0
		H2S	1	89.60	0.0	0.0	0.0
		01000					
TONIC STRE	NGTH = 0.10991	ION	C BALANCE :	CATIONS ()	10L.EQ.)0.10623719		
				ANIONS ()	MOL.EQ.)0.11206885		
				DIFFERENCE	E (%) -5.34		
DEEP WATER	(PPM)			DEEP	STEAM (PPH)	GAS PRE	ESSURES (BARS ABS+)
SI02	508,89	C02	786+80	C02	70179.68	C02	0.171E+01
NA	1649,14	H2S	24.29	H2S	657.35	H2S	0.207E-01
K	371,60	H2	0.00	H2	0.00	H2	0.000E+00
CA	16.50	02	0.00	02	0.00	02	0.000E+00
MG	0.046	CH4	0.00	CH4	0.00	CH4	0.000E+00
S04	17.89	N2	0.00	N2	0.00	N2	0.000E+00
CL.	3050.53	NH3	0.00	NH3	0.00	NH3	0+000E+00
F	0.00					H20	0.595E+02
DISS.S.	0.00					TOTAL	0.612E+02
AL	0.0000						
D	37 4444			H20	(%)	4.47	

H20 (%)

BOILING PORTION

4.47

0.23

GAS SOLUBILITY MULTIPLYING FACTOR : 1.00

37.4664

0.0000

B

FE

		*******	********		*******	*********		********	*******	errezendend	
ACTIVITY	COEFFICIEN	TS IN DE	EP WATER								
144	0+702	1	K304-	0.643	F	E++	0.183	FE	CL+	0.614	
OH-	0.602		F-	0,602	F	Ettt	0.041	AL	+++	0.041	
H3SI04-	0.614	1	CL-	0.590	F	EOHt	0.635	AL	DH++	0.171	
H2SI04	0+171	1	NAt	0.614	F	E(OH)3-	0.635	AL	(OH)2+	0.643	
H2B03-	0.576	1	K †	0.590	F	E(OH)4	0.163	AL	(OH)4-	0.625	
HC03-	0.614		CA++	0,183	F	EOH++	0.163	AL	504+	0,625	
C03	0.152	1	MG++	0,223	F	E(0H)2+	0.643	AL	(\$04)2-	0.425	
HS-	0.602		CAHC034	0.654	F	F(0H)4-	0.643	AL	F44	0.171	
S	0.163		ACHC024	0.414	F	ESOA4	0.635	AL 1	F24	0.443	
UCDA-	0.405		CADUL	A LEA	, C	ECI TT	0.147	AL	EA-	0.425	
004-	0+020		CHURT	0.004	r	EULTT EPL 01	V+100	AL		0+023	
NACOA	0 1 1 1 L AT		NUAL	V+000	r (*	EGLZT	0 444	HLI AL	F.J	0.132	
N8504**	0+040		NIT4T	0+3/0	٤	CUL4-	V+014	HL	r 0	0+014	
PHENTCAL	POMPONENTO	TA DEED	NATED (DOM AND LOC	101 E1						
UL CAOT A	CONFORENTS	IN DEEP	WHIER /	KOLI	A AA	6 767		00137	A AA	A AAA	
Ht (AUI+)	0.00	-5.526		Rutt	0.04	-0./03	FE.	(UH/3	0+00	0.000	
08-	0.09	-5+269		NACL	370,25	-2.198	FE	(OH)4-	0.00	0+000	
H4SI04	813.66	-2+072		KCL	35.80	-3,319	FE	CL+	0.00	0,000	
H3SI04-	0.24	-5,600		NASO4-	3,83	-4.492	FE	CL2	0.00	0.000	
H2SI04	0.00	-11.169		KS04-	5.43	-4.396	FE	CL++	0.00	0.000	
NAH3SI04	0.15	-5.902		CAS04	1.31	-5.016	FE	21.2+	0.00	0.000	
H3803	214.21	-2.440		MGSDA	0.01	-7.081	FFI	13	0.00	0.000	
H0000	0.00	-5.057		CAC07	0.00	-7.527	FE	91 A_	0.00	0.000	
120007	1100.07	4 751		80007	0.00	14 04/	F E	204	V 1 V V	0+000 A AAA	
HZCU3	1100.87	-1+/01		MGCU3	0.00	-11+210	FE.	904	0+00	0.000	
HCO3-	6.66	-3+962		CAHCU3+	2+14	-4+6/5	FE	5044	0+00	0+000	
CO3	0.00	-9,310		MGHC03+	0.00	-8+172	AL	+++	0.00	0,000	
H2S	24.02	-3,152		CADH+	0.01	-6+734	ALI)H++	0.00	0.000	
HS-	0.25	-5.114		MGOH+	0.00	-7.346	AL.	(OH)2+	0.00	0.000	
S	0.00	-13,834		NH40H	0.00	0.000	AL	(OH)3	0.00	0.000	
H2S04	0.00	-10,886		NH4+	0.00	0.000	AL	(OH) 4-	0.00	0.000	
HS04-	2.44	-4.599		FE++	0.00	0.000	ALS	504+	0.00	0.000	
904	7.59	-4.107		LETTT	0.00	0.000	AL	(\$04)2-	0.00	0.000	
UC	0.00	0.000		FEOUL	0 00	0.000	AL 0	11	0.00	0.000	
DF (*	0.00	0.000		FEDAT FELOUSA	0.00	0.000	PILI AL I	TT	0.00	0.000	
	0.00	0+000		FELON/2	0.00	0.000	PLI	- 27	0.00	0.000	
CL-	2808.91	-1.101		FE(0H)3-	0+00	0+000	AL	. 3	0.00	0,000	
NAT	1502.71	-1.185		FE(OH)4	0.00	0,000	AL	-4-	0.00	0,000	
K+	351.25	-2+047		FE(0H)++	0.00	0.000	ALF	5	0+00	0.000	
CA++	15.26	-3+419		FE(0H)2+	0.00	0.000	AL		0.00	0.000	
IONIC STR	ENGTH = 0	•07779	IONI	C BALANCE :	CATION ANIONS DIFFER	S (MOL.EQ.) (MOL.EQ.) ENCE (%)	0.075133 0.079519 -5.0	52 77 57			
CHEMICAL	GEOTHERMON	ETERS DE	GREES C		1000/T	DEGREES KE	ELVIN =	1,82			
DHART7	257.8										
CUAL CEDOX	207+0 V 000 0										
UNMELLEDON	704 1										
NAK	304+1										
OXIDATION	POTENTIAL	(VOLTS)	:	EH H2S= -0.40	62 EH	CH4= 99.99	9 EH I	12= 99,999	P EH RH3	3= 99,999	
LOG SOLUB	ILITY PROD	UCTS OF 1	INERALS	IN DEEP WAT	ER						
	TEO	R. CAL	_C.		TEO	R. CALC.	¢.		TEOR.	CALC.	
ADU ARTA	-14.3	73 99.4	999	ALBITE LOW	-13.9	44 99.999	AN	LCIME	-11,591	99,999	
ANHYDRITE	-0.5	73 -0.1	108	CALCITE	-13.4	27 -14.284	CH	LCEDONY	-1.899	-2.072	
MO. CULODI	TE _0/ 0	07 00 0	000	FLUDDITE	-11 0	07 00 000	0 00	THITE	7,490	90,000	
NO-CHLORI	TE -00+7	70 77	177	NTODON THE	-11+0	00 00 000		METTTE	-14 474	00 000	
LAUMUNTIT	E =24+7	74 99.	777	MICROCLINE	-14.9	0V 77+777	nal va	MONTHOD	-14+9/0	77+777	
CA-MONTHO	R, −72,5	/8 99.	999	K-MONTMOR+	-33+8	29 99,999	r MG	-MONTHUK	-/4+086	77 1777	
NA-MONTMO	IR+ -34+1	08 99.9	999	MUSCOVITE	-17.8	41 99,999	PRI	HNITE	-38,232	77+777	
PYRRHOTIT	TE -6.7	54 99.1	999	PYRITE	-23.3	33 99,999	7 QU	ARTZ	-2,004	-2+072	
WAIRAKITE	-25.03	72 99.9	799	WOLLASTONIT	E 7.0	78 4+823	5 Z01	ISITE	-39,157	99.999	5
EPIBOTE	-38.9	47 99+9	999	MARCASITE	-7.3	44 99,999	2				0

GEOCHEMISTRY OF WELL DKOY-5 ORKUSTOFNUN JHD 1982-11-12 OLIVER S.NEGROS, PHILIPPINES BALAS-BALAS TEMPERATURE FIXING STEAM LOSS 100.0 DEGREES C PROGRAM WATCH3. WATER SAMPLE (PPM) STEAM SAMPLE PH/DEG.C 7.22/25.0 GAS (VOL.%) REFERENCE TEMP. DEGREES C 264.0 (ARBITRARY) SI02 1073.00 C02 SAMPLING PRESSURE BARS ABS. H2S 3347.00 NA H2 DISCHARGE ENTHALPY MJOUL/KG 820.00 K KG/SEC. 29.0 CA. 35.10 02 DISCHARGE MG 0.040 CH4 N2 MEASURED TEMPERATURE DEGREES C C02 68.50 0.0 RESISTIVITY/TEMP: OHMM/DEG.C 0.0/ 0.0 S04 61.50 MV/DEG.C 0.000/ 0.0 H2S 9.88 EH/TEMP+ CL 5993.00 LITERS GAS PER KG CONDENSATE/DEG.C F 0.00 MEASURED DOWNHOLE TEMP, FLUID INFLOW DISS.SOLIDS 0.00 0,0000 DEGREES C/METERS DEPTH (METERS) AL B 73.0000 0.0000 CONDENSATE (PPM) 0.0 0.0 0.0 FE 0.0 0.0 0.0 0,0000 PH/DEG.C NH3 0.0 0.0 0.0 C02 H2S 0.0 0.0 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 0.0 0.0 0.0 CONDENSATE WITH NAOH (PPM) 0.0 0.0 C02 0.0 0.0 0.0 H2S 0.0 0.0 IONIC STRENGTH = 0.17111 IONIC BALANCE : CATIONS (MOL.EQ.)0.16779573 ANIONS (MOL.EQ.)0.17154194 DIFFERENCE (%) -2,21 GAS PRESSURES (BARS ABS.) DEEP STEAM (PPM) DEEP WATER (PPM) 27568.29 C02 C02 0.00 C02 0.641E+02 SI02 723.34 H2S 0.171E+01 H2S 1867,72 H2S 0.00 2256,11 NA H2 0.00 0.000E+00 H2 K 552,71 H2 0.00 02 0.00 02 0.00 02 0.000E+00 CA 23.66 0.027 CH4 0.00 CH4 0.000E+00 CH4 0.00 MG N2 N2 N2 0.000E+00 0.00 0,00 \$04 41.45 4039.36 NH3 0.00 NH3 0.00 NH3 0.000E+00 C1. H20 F 0.00 0.501E+02 TOTAL 0.116E+03 DISS.S. 0.00

H20 (%)

BOILING PORTION

0.00

0.00

GAS SOLUBILITY MULTIPLYING FACTOR : 1.00

0.0000

49,2025

0.0000

AL

8

FE

					*****	*********	=======				an e an an air ann ann ann ann ann ann ann ann ann
ACTIVITY	POCCETOTEN	TO TH DO	D HATED								
MOLIVILL	A 201	13 17 001	COA-	5 494		TELL	A 140			A 507	
0U_	0 500		1004-	0.500		CCTT CCTT	0 077		AI LLL	0.077	ñ
UZCTOA-	0.507	1	· -	0.544		FENUL	0.417		AL DULL	0.154	
H2ST04	0.154		104	0.507	24	EE(04)7-	0.617		AL (AU) 21	0.494	
42803-	0.551		(4	0.544		E(04)/	0.149			0.404	
HC03-	0.593	1	144	0.149		CCONTR	0.149		AL CONV.	0.404	
C03	0.137		611	0.211	X	CON124	0.474		AL (COA)2-	0.000	
HS-	0.580	í	1011 1011	0.479		FE(OH)A-	0.424		AI CTT	0.154	
C	0.148		100001	0.597	5	TERNAL	0.417		VI E.J.T.	0.424	
HSUT-	0.404	, r	,90011 100021	A. 479		C0041	0.149			0.404	
904	0.124	à	160H4	0.449		FCI 24	0.417			0.137	
NASA4-	0.624		H44	0.551		FFCI A-	0.593		AL FA	0.011	
101201	01010			01001		Nor William 1	01010		The I of		
CHEMICAL	COMPONENTS	IN DEEP	WATER (P	PM AND LOG	MOLE)						
Ht (ACT.)	0.02	-4,732		MG++	0.02	-5.991	ſ	E(OH)3	0.00	0.000	
OH-	0.01	-6+056		NACL	445.01	-2+118	F	E(OH)4-	0.00	0.000	
H4SIO4	1156,94	-1+920		KCL	50.00	-3.174	1	FECL	0.00	0.000	
H3SI04-	0,07	-6.138		NASO4-	6.76	-4.246	F	FECL2	0.00	0.000	
H2SI04	0.00	-12.381		KS04-	9.00	-4.176	5	FECL++	0.00	0.000	
NAH3SIC4	0.05	-6.350		CASO4	1,62	-4.925	F	ECL2+	0.00	0.000	
H3B03	281.40	-2,342		MGSO4	0.01	-7,221	F	ECL3	0.00	0.000	
H2B03-	0.02	-6+480		CACO3	0.00	-7.488	F	ECL4-	0.00	0.000	
H2C03	38793.44	-0.204		MGCO3	0.00	-11.402	F	ES04	0.00	0.000	
HCO3-	52,90	-3.062		CAHCO3+	14.62	-3.840	F	ES04+	0.00	0.000	
C03	0.00	-9.045		MGHC03+	0.00	-7.599	1	12+++	0.00	0.000	
H2S	1863.09	-1.262	1	CAOHt	0.00	-7,589	A	LOH++	0.00	0.000	
HS-	4.49	-3.867		MGOHt	0.00	-8,582	f	L(OH)2+	0.00	0.000	
S	0.00	-13.411		NH40H	0.00	0.000	f	L(OH)3	0.00	0.000	
H2S04	0.00	-9.358		NH4+	0.00	0.000	6	AL(OH)4-	0.00	0,000	
HS04-	15.73	-3,790	1	FE++	0.00	0.000	f	LS04+	0.00	0+000	
S04	12.89	-3.872		FE+++	0.00	0.000	4	L(S04)2-	0.00	0+000	
HF	0.00	0.000	3	FEOH+	0.00	0.000	F	LF++	0.00	0.000	
F-	0.00	0.000		FE(OH)2	0.00	0.000	A	LF2+	0.00	0.000	
CL-	3745+64	-0+976		FE(OH)3-	0.00	0.000	A	LF3	0.00	0.000	
NA+	2079.73	-1.044	1	FE(OH)4	0.00	0.000	F	LF4-	0.00	0.000	
Кŧ	523,88	-1.873	1	FE(OH)++	0.00	0.000	A	LF5	0.00	0.000	
CA++	17,38	-3,363		FE(OH)2+	0.00	0.000	F	LF6	0.00	0.000	
IONIC STR	ENGTH = 0.	10647	IONIC	BALANCE :	CATION ANIONS DIFFEF	IS (MOL.EQ.) 6 (MOL.EQ.) RENCE (%))0.10487)0.10693) -1	515 281 .94			
CHENTCOL	GEOTHERMOM	FTERS DEC	REES C		1000/1	r degrees ki	ELVIN =	1.86			
write 116 Wille	solward that 07/07/11	are and the first of the first	- Constant for the								
QUARTZ	297.6										
CHALCEDON	17 999+9										
NAK	314+9										
OXIDATION	POTENTIAL	(VOLTS)	: E	H H2S= -0.3	67 E	I CH4= 99.9	99 EH	H2= 99.	999 EH N	H3= 99,999	
LOG SOLUB	ILITY PRODU	JCTS OF M	INERALS	IN DEEP WAT	ER						
	TEOP	R. CAL	.C.		TEC	IR+ CALC	•		TEOR	. CALC.	
ADULARIA	-14.37	74 99.9	99	ALBITE LOW	-13.9	38 99,99	9 P	NALCIME	-11.55	4 99.999	
ANHYDRITE	-8.36	66 -8.9	0.6	CALCITE	-13,1	36 -14.04	2 0	HALCEDON	Y -1.94	0 -1.920	
MG-CHLORI	TE -86.02	28 99.9	99	FLUORITE	-11.0	34 99,99	96	OETHITE	3.05	8 99,999	
LAUMONTIT	E -24.67	79 99.9	99 1	HICROCLINE	-15.0	08 99.999	7 M	AGNETITE	-15.56	7 99.999	
CA-MONTMO	R+ −72+58	32 99.9	99	K-MONTMOR .	-33.8	388 99,99	9 1	IG-MONTMO	R, -74,09	0 99.999	
NA-MONTMO	R34.16	69 99.9	99	NUSCOVITE	-17.8	337 99.999	9 F	REHNITE	-37.81	0 99.999	
PYRRHOTIT	E -13.08	32 99.9	99	PYRITE	-31.3	297 99,99	90	IUARTZ	-2.04	7 -1.920	
WAIRAKITE	-24+82	27 99+9	99 1	DLLASTONIT	E 7,2	253 3.41:	1 Z	OISITE	-38,60	5 99,999	
EPIDOTE	-38,18	34 99,9	99	MARCASITE	-14.9	75 99.99	9				

ORKUSTOFNU 1982-11-12	N JHD OLIVER		GEOCHEMISTRY OF	WELL OKOY	-6			
7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.	8108232222 OKOY	-6			S.NEGROS,	PHILIPPINES N	ASUJI	
PROGRAM WA	TCH1.							
WATER SAMP	LE (PPM)	ST	EAN SAMPLE					
PH/DEG+C	6+60/25+0	GA	S (VOL.%)		REFERENCE TEM	P. DEGREES	S C 285.0	(MEASURED)
SI02	725+60	CO	2	0.00				
NA	2411.00	H2	S	0.00	SAMPLING PRES	SURE BARS AI	85. 11.1	
К	480.00	H2		0.00	DISCHARGE ENT	HALPY MJOUL	/KG 1.263	(MEASURED)
CA	31.90	02		0.00	DISCHARGE	KG/SI	EC. 13.2	
MG	0.030	CH	4	0.00				
C02	6.60	N2		0+00	MEASURED TEMP	ERATURE DEGREES	0.0 C	
S04	32.50				RESISTIVITY/T	EMP, OHMM/DEG	3.C 0.0/	0.0
H2S	0.00				EH/TEMP.	HV/DEC	3.C 0.000/	0.0
CL	4436.00							
F	0.00	LI	TERS GAS PER KG					
DISS.SOLTR	5 0.00	CO	NDENSATE/DEG.C	0.00/ 0.0	MEASURED D	NUNHOLE TEMP.	FLUID INFLO	1 H
Al	0.0000				DEGREES	C/METERS	DEPTH (METER	25)
B	52,0000				Pla VI Hote V	er men en en e	When the title the	107
FF	0.0000	co	NDENGATE (PPM)		0.0	0.0	0.0	
MUZ	0.0000	PL	/DEC C	0.00/ 0.0	0.0	0.0	0.0	
1010	440000	C0	7 0 - 0 + 0	0.00	0.0	0.0	0.0	
		60.	2	0.00	0.0	0.0	0.0	
		114	5	0+00	0.0	0.0	0.0	
		NH		0+00	0+0	0.0	0.0	
					0+0	0+0	0.0	
					0+0	0.0	0.0	
		00			0.0	0.0	0.0	
		CU	NUENSAIE WITH N	AUH (PPM)	0.0	0.0	0.0	
		CU	2 12/-	38,00	0.0	0+0	0.0	
		H2	5 2	04,40	0+0	0.0	0+0	
IONIC STREE	NGTH = 0,12317	I	DNIC BALANCE :	CATIONS	MOL.EQ.)0.11848	136		
				ANIUNS	RUL+EU.)0.12364	923		
				DIFFEREN	λΕ (%) -5.	*8/		
DEEP WATER	(PPH)			DEEP	STEAM (PPM)	GAS PRE	SSURES (BARS	ABS.)
SI02	551.23	C02	2972.49	C02	213048.64	C02	0.603E+01	
NA	1831.46	H2S	48.73	H2S	1059.15	H2S	0.387E-01	
K	364.60	H2	0.00	H2	0.00	H2	0.000E+00	
CA	24.23	02	0.00	02	0.00	02	0.000E+00	
MG	0.023	CH4	0.00	CH4	0.00	CH4	0.000E+00	
\$04	24.69	N2	0,00	N2	0.00	№2	0.000E+00	
CL	3369,41	NH3	0.00	NH3	0.00	NH3	0.000E+00	
F	0.00			1.1.10		H20	0+692E+02	
DISS.S.	0.00					TOTAL	0.752F+02	
AI	0.0000					10 mu	VII VALIVA	
R	20.4040			H20	(%)	0.05		
EC.	0.0000			0011	THE PORTION	0.24		
r G	A 10000			DUIL	THO FORITOR	V+27		

GAS SOLUBILITY MULTIPLYING FACTOR : 1.00

			2. Mar 241 M.							
ACTIVITY (COEFFICIEN	TS IN DEEP W	ATER		22:27	2 222				
H+	0.685	KS04	- 0,622	FE	[++	0.162	FECL	÷	0.591	
0H-	0.578	F	0.578	FE	+++	0.033	AL++	4	0.033	
H3SI04-	0.591	CL-	0.565	FE	:0H+	0.613	ALOH	++	0.150	
H2SI04	0,150	NAt	0.591	FE	E(OH)3-	0.613	AL(0	H)2+	0.622	
H2803-	0.551	K+	0,565	FE	(OH)4	0.142	AL(O	H)4-	0.602	
HCO3-	0.591	CA++	0.162	FE	14HO	0.142	ALSO	4+	0,602	
C03	0.132	MG++	0.201	FE	(OH)24	0.622	AL(S	04)2-	0.602	
HS-	0.578	CAHC	03+ 0.634	FE	(OH)4-	0.622	ALFt	÷	0.150	
S	0+142	MGHC	0.591	FE	S04+	0.613	ALF2	÷	0.622	
HS04-	0.602	CAOH	+ 0.634	FE	CL++	0,142	ALF4	_	0.602	
504	0.122	MGOH	+ 0.644	FE	CL2+	0.613	ALF5		0.132	
NASO4-	0.622	树村本中	0.551	FF	r:1 4-	0.591	ALEA		0.010	
richese t	W V Iv die dae	14111		1 14	rafte i	01014	176.1 67		01020	
CHENTCOL C	OMPONENTS	TN DEEP HAT	CO (DOM AND I DO M	01 51						
UL /ACT 1		_A 007	WOLL	A 49	-4 045	55/001	T	0 00	0.000	
DT (HUIS)	0 002	-1+02/ E 0E1	NACI	0+02	-0+04U	FE(UN)	0	0.00	0 000 0 000	
UM-	V+VZ	-3+431	NACL	J03+2/	-2+010	FE(UR)	4-	0.00	V AAA	
H45104	881+68	-2.038	KUL	44.60	-3+223	FELLT		0.00	0.000	
H35104-	0+04	-6.335	NASU4-	5.15	-4.580	FECL2		0.00	0.000	
H2S104	0.00	-12+653	KS04-	9.61	-4+467	FECLH	•	0.00	0.000	
NAH3SI04	0.03	-6.618	CASO4	1+46	-4.970	FECL24	•	0.00	0.000	
H3B03	225.89	-2.437	MGSO4	0.00	-7,550	FECL3		0.00	0.000	
H2803-	0.02	-6.543	CAC03	0.00	-8.267	FECL4-	6	0.00	0.000	
H2C03	4184.33	-1.171	MGC03	0.00	-12.481	FESO4		0.00	0.000	
HC03-	3,97	-4,187	CAHC03+	1.99	-4.705	FES04+	5	0.00	0.000	
C03	0.00	-10,307	MGHC03+	0.00	-8,676	AL+++		0.00	0.000	
H2S	48.65	-2.845	CAOH+	0.00	-7,217	ALOH++	6	0.00	0.000	
HS-	0.08	-5.618	MGOH+	0.00	-8.197	AL(OH)	2+	0.00	0.000	
S	0.00	-14.946	NHAOH	0.00	0.000	AL (OH)	3	0.00	0.000	
HOSOA	0.00	-9.453	NHA+	0.00	0.000	AL (OH)	4-	0.00	0.000	
uena_	10 14	-7 007	EETT	0.00	0.000	51 CDA1		0.00	0.000	
004-	12+14	-0+700	FEILL	0.00	0.000	AL (CO)	112-	0.00	0.000	
004	0.00	-4.217	FETT	0 00	0.000	ALCII	14	0.00	0 000	
nr F	0+00	0.000	FEURY	0.00	0.000	ALEGI		0.00	0.000	
-	0400	0.000	FE(UN)2	0.00	0.000	HLFZT		0000	0.000	
UL-	3008133	-1,072	FE(00)3-	0.00	0.000	MELED ALEA-		0.00	0.000	
NAT	1509+26	-1,100	FE(UH)4	0+00	0.000	ALF4-		0+00	0.000	
K+	339,88	-2.061	FE(UH)++	0+00	0.000	ALF D	•	0.00	0+000	
CA++	23+01	-3.241	FE(OH)2+	0.00	0.000	ALF6		0.00	0.000	
IONIC STRE	NGTH = 0	08307	IONIC BALANCE :	CATIONS	(MOL.EQ.)	0.07986062				
				ANIUNS	ITUL+EU+.	10+08000110				
				DIFFERE	RLE (2)	-0.24				
CHEMICAL G	EOTHERMON	ETERS DEGREE	S C	1000/7	DEGREES K	ELVIN = 1.79				
OUADT7	244 A									
CUAL CEDOMY	200+7									
CHALCEDONT	777+7									
NAK	788*0									
OXIDATION	POTENTIAL	(VOLTS) :	EH H2S= -0,38	2 EH	CH4= 99.99	79 EH H2=	99,999	EH NH3	5= 99,999	
LOG SOLUBI	LITY PROD	UCTS OF MINE R. CALC.	RALS IN DEEP WATE	R TEOR	. CALC.			TEOR.	CALC	
ATH ARTA	-14.7	36 99,999	ALBITE LOW	-13.94	3 99,990	ANAL CT	ΗE	-11.637	99.999	
ANNAUGUTE	.0.7	40 -0.144	COLCITE	-17.40	6 -15.000		DONY	-1.847	-2.038	
MRDINNIIC	-04/4 E .05 M	22 00 000	CHEDITE	10007	4 00 000	0 000000	TC	A. 77A	00.000	
NO"UNLUKI	E 70/17	66 771777 Ni on con	FLOORITE	G1+11-	0 00 000		TTE	-17 4/0	00 000	
LAUMUNTITE	24.9	(1 77+777 (A 00 000	MICKULLINE	-14+7/	4 77 .777	TRUME I	TIC	-74 070	77+777	
CA-MUNTMOR	-/2.5	59 99,999	N-MONTAUK+	-33,/6	0 77+77		TE	-/4+V/2	771777	
NA-MUNIMUR	+ -54+0	D1 99,999	MUSCUVITE	-1/,84	J 77,775	PRENRI	1E	-201043	771777	
PYRRHUTITE	-0+9	37 79,999	PTRITE	-16.04	1 99,99	7 GUAR12		-1,700	-2+038	
WAIRAKITE	-25.3	14 99,999	WULLASTONITE	6.92	2 3+584	201511	E	-37:690	44*444	
EPIDOTE	-39.8	16 99 ₊99 9	MARCASITE	-0,34	5 99+99	7				

DRKUSTOFNUN JHD 1982-11-12 OLIVER GEDCHEMISTRY OF WELL DKOY-7

S.NEGROS, PHILIPPINES PUHAGAN

PROGRAM WATCH1.

FE

0.0000

WATER SAMPLE (PPM) STEAM SAMPLE REFERENCE TEMP, DEGREES C 318.0 (MEASURED) PH/DEG.C 6.97/25.0 GAS (VOL.%) SI02 867.00 CO2 0.00 NA 3161.00 H2S 0.00 SAMPLING PRESSURE BARS ABS. 9.3 724.00 H2 118.00 D2 0.130 CH4 32.70 N2 DISCHARGE ENTHALPY MJOUL/KG 1,448 (CALCULATED) 0.00 K 0.00 CA DISCHARGE KG/SEC. 29.5 0.00 MĠ 0.00 MEASURED TEMPERATURE DEGREES C 0.0 002 RESISTIVITY/TEMP, OHMM/DEG.C 0.0/ 0.0 28.00 S64 MV/BEG.C 0.000/ 0.0 H2S 0.10 EH/TEMP. CL 5788.00 0.00 LITERS GAS PER KG 0.00 CONDENSATE/DEG.C 18.20/25.0 MEASURED DOWNHOLE TEMP. FLUID INFLOW F DISS.SOLIDS DEGREES C/METERS DEPTH (METERS) AL 0.0000 B 69.3000 FE 0.0000 CONDENSATE (PPM) 0.0 0.0 0.0 0.0 NH3 0.0000 PH/DEG+C 0+00/ 0+0 0.0 0.0 0.0 C02 0.00 0.0 0.0 0.0 0.0 H2S 0.00 0.0 0.0 0.0 NA 0.00 0.0 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 NACH (PPM) 0.0 0.0 34296.00 0.0 C82 0.0 H2S 695.70 IONIC STRENGTH = 0.16599 IONIC BALANCE : CATIONS (MOL.EQ.)0.16148533 ANIONS (MOL.EQ.)0.16411228 DIFFERENCE (%) -1.61 DEEP STEAM (PPM) GAS PRESSURES (BARS ABS.) DEEP WATER (PPM)
 567.29
 CO2
 11879.01

 2068.10
 H2S
 240.60

 473.66
 H2
 0.00

 77.20
 D2
 0.00

 0.085
 CH4
 0.00

 18.32
 N2
 0.00

 3786.52
 NH3
 0.00
 C02 C02 0.00 0.182E+02 ST02 0.143E+00 H2S 0.00 H2S NA 0.00 H2 0.000E+00 H2 K 02 0.00 02 0.000E+00 ČA. 0.00 CH4 0.00 CH4 0.000E+00 MG N2 0.00 N2 0.000E+00 \$04 0.00 NH3 NH3 0.000E+00 0.00 CL 0.00 H20 0.110E+03 F DISS.S. 0.00 TOTAL 0.128E+03 AL 0.0000 H2G (%) B 45.3358 0.00

BOILING PORTION

0.00

			25					
ACTIVITY	COEFFICIEN	TS IN DEEP WATER	{	12220	21	(a)()) (a)(a)(a)		3 2237
HŦ	0.630	KS04-	0.559	FE	t	0.107	FECL+	0.524
0H-	0.510	F-	0.510	FE÷	++	0.016	AL+++	0.016
H3S104-	0,524	CL-	0,495	FEO	H÷	0.549	ALOH++	0.098
H2SI04	0+098	NA+	0+524	FE(OH)3-	0.549	AL(0H)2+	0,559
H2B03-	0+480	K+	0+495	FE(DH)4	0.091	AL(0H)4-	0.537
HC03-	0.524	CA++	0+107	FEO	H++	0+091	ALS04+	0.537
C03	0.083	MG++	0.141	FE(DH)2+	0.559	AL(SD4)2-	0.537
HS-	0.510	CAHC03+	0+572	FE(1	0H)4-	0.559	ALF++	0.098
S	0.091	MGHC03+	0.524	FES	34+	0.549	ALF2+	0.559
HS04-	0.537	CAOH+	0.572	FECI	_ ++	0.091	ALF4-	0.537
S04	0.075	MGOH+	0.583	FECI	.2+	0.549	ALF5	0.083
NAS04-	0.559	NH4+	0.480	FECI	4-	0.524	ALF6	0.004
CHEMICAL (COMPONENTS	IN DEEP WATER (PPM AND LOG	MOLE)				
H4 (ACT.)	0.01	-4.915	MG++	0.08	-5,472	FE(OH)3	0.00	0.000
0H-	0.02	-5.399	NACL	1557.53	-1.574	FE(0H)4-	0.00	0.000
H4ST04	907.39	-2.025	KCL	119.51	-2.795	FECL+	0.00	0.000
H3SI04~	0.03	-6.510	NAS04-	1.22 .	-4.989	FECL2	0.00	0.000
H2SI04	0.00	-12,934	KS04-	5.14	-4.420	FECL++	0.00	0.000
NAHISTOA	0.02	-6.866	CASDA	1.72 .	-4.899	FECL 24	0.00	0.000
H7807	259.28	-2.377	MGSD4	0.00	-7.554	FECI 3	0.00	0.000
H0800	0.05	-4. 447	CAC07	0.00	-7.755	FECLA-	0.00	0.000
02003	14705 57	-0.540	YECOZ	0.00 -	1.450	FEGNA	0.00	0.000
02005	0 74	-7 0/4	00000	10.17	T OAA	EECOAL	0.00	0.000
007	0+31	-10 1/7	VELCOT	14+4/	7 770	AL LLL	0.00	0.000
U03	0.00	-10+100	PADUL	0.04	/ 507	HLTTT AL OULL	0.00	0.000
120	240+41	-2+132	LHUNT	0.00	7 405	HLUATT	0+00	0.000
H5-	0+19	-0+247	NGUNT	0+00	-/+U7J	AL (UM)ZT	0.00	V+000
5	0+00	-14,202	NH40H	0+00	0.000	ALCONIS	0+00	0+000
H2S04	0.00	-9.507	NH4+	0+00	0,000	AL(UH)4-	0.00	0.000
HS04-	10.10	-3.983	FE++	0.00	0.000	ALSU4+	0.00	0.000
S04	2.47	-4+589	FE+++	0.00	0.000	AL(S04)2	- 0.00	0.000
HF	0.00	0.000	FEOHt	0.00	0.000	ALF++	0.00	0,000
F-	0+00	0.000	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	2784+88	-1,105	FE(0H)3-	0.00	0+000	ALF3	0+00	0.000
NAt	1455.14	-1,199	FE(0H)4	0+00	0.000	ALF4-	0.00	0+000
K+	409+50	-1.980	FE(0H)++	0.00	0.000	ALF5	0.00	0.000
CA++	70,95	-2+752	FE(OH)2+	0.00	0+000	ALF6	0.00	0.000
IONIC STR	ENGTH = O	.07990 IONI	C BALANCE :	CATIONS ANIONS DIFFERENC	(MOL.EQ.) (MOL.EQ.) CE (%)	0.07745818 0.07875313 -1.66		
CHEMICAL	GEOTHERNOM	ETERS DEGREES C		1000/T D	EGREES KE	LVIN = 1.69		
0110917	240 5							
CUAL CEBON	V 000 0							
NAK	777+7							
NHA AY INATIAN	POTENTIAL	(UNITS) :	FH H2S= -0.4	43 FH C	14= 99,99	9 EH H2= 99	.999 EH N	H3= 99.999
001001100	1 D H HILL THE	1902107 1	En 1120 911	19 6/1 9/	11 11111	2 mil the fit		
LDG SOLUB	ILITY PROD	UCTS OF MINERALS	IN DEEP WAT	ER	CALC		TEOR	CALC.
ADUI ADTA	-14 5	24 00.000	AL RETE LOP	-14, 114	99,990		-11.84	0 99,999
AMUVDOTTE	14110	61 ////// 04 _0 A77	PAL PITC	-14 200		CHAI CEDO	NY _1.75	7 -2.025
MO. OUL OPT	TE 04 3	10 00 000	CLUODITE	14 7/0	00 000	00000000	2.07	1 00.000
NO-CHEURI	12 -71.5	10 77+777	FLOORITE	-11.300	77 + 77	VACUETTE	C -10 0+2/	17+777 7 00 000
LAUMUNITI	-25,4	00 77+777	MICROCLINE	-13:020	17+777	THORE II (C 1V+V4	77+777
CA-MONTHO	K+ -72+2	79 99,999	K-MUNIMUR.	-33.4/8	79,99		08+ -/3+/9	0 77+777 7 00 000
NA-MONTMO	R33.7	30 99+999	MUSCUVITE	-1/,840	99,999	PREHNITE	-40+18	77+777
PYRRHOTIT	E 18.6	77 99.999	PIRITE	8.400	99,999	WUAR12	-1.84	7 -2+025
WAIRAKITE	-26+2	35 99+999	WOLLASTONIT	E 6+431	4+083	ZOISITE	-41.64	99,999
EPIDOTE	-43.9	32 99.999	MARCASITE	23+189	99.999	ť		
ORKUSTOFNUN JHD GEOCHEMISTRY OF WELL OKOY-8 1982-11-12 OLIVER S.NEGROS, PHILIPPINES NASUJI PROGRAM WATCH3. TEMPERATURE FIXING STEAM LOSS 100.0 DEGREES C WATER SAMPLE (PPH) STEAM SAMPLE PH/DEG.C 7,85/25.0 GAS (VOL.%) REFERENCE TEMP. DEGREES C 244.0 (ARBITRARY) SI02 864.00 C02 H2S NA 2771.00 SAMPLING PRESSURE BARS ABS. H2 K 636.00 DISCHARGE ENTHALPY MJOUL/KG CA 33.60 02 DISCHARGE KG/SEC: 32.6 MG 0.050 CH4 6.98 C02 N2 MEASURED TEMPERATURE DEGREES C 0.0 S04 36,10 RESISTIVITY/TEMP. OHMM/DEG.C 0.0/ 0.0 6.48 H2S EH/TEMP, MV/DEG.C 0.000/ 0.0 CL 5262.00 F 0.00 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 64,4000 FE 0.0000 CONDENSATE (PPM) 0.0 0.0 0.0 NH3 0.0000 PH/DEG.C 0.0 0.0 0.0 C02 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 CONDENSATE WITH NAOH (PPM) 0.0 0.0 0.0 C02 0.0 0.0 0.0 H29 0.0 0.0 0.0 IONIC STRENGTH = 0.14498 IONIC BALANCE : CATIONS (MOL.E0.)0.13799763 ANIONS (MOL.EQ.)0.14961219 DIFFERENCE (%) -8.08 DEEP WATER (PPM) DEEP STEAM (PPM) GAS PRESSURES (BARS ABS.) C02 SI02 620,16 C02 1672.52 C02 0.00 0.440E+01 H2S 1988.78 H2S 757.91 0.00 H2S 0.792E+00 NA K 456.44 H2 0,00 H2 0.00 H2 0.000E+00 CA 24.12 02 0.00 02 0.00 02 0.000E+00 CH4 CH4 0.00 0.00 CH4 0.000E+00 MG 0.036 S04 25.91 N2 0.00 N2 0.00 N2 0.000E+00 NH3 NH3 0.00 NH3 0.000E+00 CL 3776.28 0.00 F 0.00 H20 0.359E+02 TOTAL 0.411E+02 DISS.S. 0,00 AL 0.0000 B 46.2164 H20 (%) 0.00 0.0000 FE BOILING PORTION 0,00

							*******				*********	mersentent
ACTIVITY (COEFFICIEN	TS IN DEEP	WATER									
Ht	0.712	KS	04- (.653	FE	H+	0.200		FECL+		0.623	
OH-	0.611	F-	().611	FE	+++	0.050		AL+++		0.050	
H3SI04-	0+623	CL	- (.598	FE)H+	0.645		ALOH++		0.187	
H2SI04	0+187	NA	+ (0.623	FE	(OH)3-	0.645		AL(OH)	2+	0.653	
H2B03-	0.584	K+	(.598	FE	(OH)4	0.177		AL (OH)	4-	0.634	
HC03-	0.623	CA	++ (.200	FE()H++	0,177		ALS04+		0.634	
C03	0.166	MG	++ (.243	FF	08)2+	0.653		AL (504))2-	0.634	
HS-	0.611	CA	HC03+ (. 665	FE	(NH)4-	0.453		ALE++		0.187	
S	0.177	MG	HC034 (. 423	FFG	044	0.645		ALE 24		0.453	
Hena	0.470	CA.	UDT (. 445	FEC	N TT N	0.177		ALEA-		0 474	
CD 4	A 1EA	Un MO	0H1 1	11000	F CL	46.TT 9.731	VII//		MLT 1		A 477	
NAGOA	V+1.14	1713	UNT C	50/4	FEU	LZT N A	0+040		HLPJ		001+0	
NA504-	1+000	PEM	4† (1+384	PEL	14-	0.623		ALL 0	-3	0+018	
		12201-12202-127799	energia in protector - 1000		12273							
CHEMICAL C	OMPONENTS	IN DEEP W	ATER (PPM AN	id log moi	LE)							
H+ (ACT,)	0.01	-5.119	MG++		0.03	-5.861		FE(OH)3	0.	00	0.000	
0H-	0.03	-5.733	NACL	2	56.65	-2.357		FE(OH)4-	0.	00	0.000	
H4SIO4	991.70	-1,986	KCL		29.03	-3.410		FECL+	0	.00	0.000	
H3ST04-	0.19	-5.699	NAS04	-	5.52	-4.334		FECL2	0.	00	0.000	
H2ST04	0.00	-11.449	KSO4-		5.75	-4.371		FECI ++	0	00	0.000	
MAUZCIDA	0 17	-5 040	CACO		1 04	-1 070		EECI 24	0	00	0.000	
MH033104	014 00	-J+747 0 7/0	CHOU-		1+01	-4+0/0		FEGLZT	0	00	0.000	
H3BU3	204+29	-2+367	MG504		0.01	-/+V03		FEGLA	U.	.00	0.000	
H2B03-	0+05	-6.092	CACUS		0.00	-/+669		FECL4-	0.	00	0.000	
H2C03	2342.25	-1,423	MGCO3	5	0.00 -	-11.456		FES04	0	•00	0*00	
HC03-	12.61	-3,685	CAHCO	34	3.69	-4,437		FESO4+	0.	.00	0.000	
C03	0.00	-9+123	NGHCC	134	0.00	-8.146		AL+++	0.	00	0.000	
H2S	750.65	-1.657	CAOH+		0.00	-7.235		ALOH++	0.	00	0.000	
HS-	7.05	-3.672	MGOH4		0.00	-8.365		AL(0H)2+	0.	00	0.000	
S	0.00	-12,992	NHAOH		0.00	0.000		AL (0H) 3	0.	00	0.000	
U2604	0 00	-10 400	MUAL		0.00	0.000			0	00	0.000	
N2007	7 50	-1V+17Z	ROAT CELL		0 00	0+000		ALCOAL	0	00	0 000	
H504-	3.02	-4,440	FETT		0.00	0.000	1	AL504+	0.	00	0.000	
504	12,58	-3.883	FE+++		0.00	0+000	3	AL(SU4)2-	0.	00	0,000	
HF	0.00	0.000	FEOH		0.00	0.000	1	ALF++	0.	00	0.000	
F	0.00	0.000	FE(OH	1)2	0.00	0.000		ALF2+	0.	00	0.000	
CL-	3606.79	-0,992	FE(OH	1)3-	0.00	0+000		ALF3	0.	00	0.000	
NAt	1886+72	-1.086	FE(OH	1)4	0.00	0.000		ALF4-	0	00	0.000	
K+	439.55	-1.949	FE(0)	1)++	0.00	0.000		ALF5	0.	00	0.000	
C4++	22.11	-3.258	FF(0)	1)24	0.00	0.000		ALF6	0.	.00	0.000	
WHEET	den das 7 de de		1 10 1 10 1									
TONTE CTOP	MOTH - A	00010	TONTE DALA	NCE ! (PATTONS	(MOL.FO.)	0.0944	51.45				
TONIC DINC	nom - v	07712	101110 1-060	11166 ÷ 1	ANTONG	(HOL CO)	0 1004	2075				
					GRUINH	(HUL+EU+/	0+1024	2700				
					UIFFEREN	RE (%)	1	8+10				
CHEMICAL G	EOTHERMON	ETERS DEGR	EES C	3	1000/T I	EGREES KE	LVIN =	1.93				
QUARTZ	279.4											
CHALCEBONY	999.9											
NAK	307.5											
1.1.1.1	00010											
OVERATION	ODTENTIAL	/00/101 1	CD 1190	0 700	EL. 6	UA- 00 00	0 5	U U2- 00	000	ธน พบว	00.000	
UXIDATION	FUIENIIAL	(VUL15) i	EH HZE	= -0+370	EFIL	114= 77+77	7 E	n n∠- 77+	777	EU RUS)-· 77+777	
LOG SOLUBI	LITY PRODU	JCTS OF MI	NERALS IN DE	EP WATER		1211121						
	TEO	R. CALC	٥		TEOR,	CALC +				TEOR .	CALC.	
ADULARIA	-14.42	24 99.99	9 ALBIT	E LO₩	-13,972	99.999		ANALCINE	-1	1.525	99,999	
ANHYDRITE	-7.99	76 -8.65	2 CALCI	TE	-12,616	-13,860	1	CHALCEDON	Y -	2.019	-1,986	
MG-CHI ORIT	F -84.4	28 99.99	9 FLUOR	ITE	-10.925	99.999)	GOETHITE		1.944	99,999	
AUMONTTE	24 5	1 00 00	0 21000	CI TNE	-15.110	00.000		MAGNETTTE	-1	7.504	99,999	
CHONORTITE CA.MONTROP	271.0	10 00 00	0 N 7507	THOD	-74 604	00 000	E B	MG_MONTHO	P	74.115	00,000	
UN HOUTHOR	+ -12+0	1/ 77+77	7 A-HUR D MUCOR		-04+020	77+777		DOCUNTTO		71110	00 000	
NA-MUNIMUK	+ -34+2	10 99+99 10 10	7 MUSCU	VIIE	-11+820	77+777		TREAMILE	-3	0 474	77+777	
FYRRHOTITE	-24, 9	01 99 .99	9 PYRIT	Ł	-95.633	99,999		UUARTZ		2.131	-1,986	
WAIRAKITE	-24,44	12 99,99	9 WOLLA	STONITE	7,585	4.294		ZOISITE	-3	7.695	99+999	
EPIDOTE	-37+28	39 99,99	9 MARCA	SITE	-28.672	99.999						

2 S

ORKUSTOFNUN JHD GEOCHEMISTRY OF WELL OKOY-9D 1982-11-12 OLIVER 2222222222228103132222 OKOY-9D S.NEGROS, PHILIPPINES PUHAGAN PROGRAM WATCH1. WATER SAMPLE (PPM) STEAM SAMPLE PH/DEG.C 7.43/25.0 GAS (VOL.%) REFERENCE TEMP. DEGREES C 291.0 (MEASURED) SI02 734.00 C02 0.00 2580.00 H2S SAMPLING PRESSURE BARS ABS. NA 0.00 4.5 555.00 H2 MJOUL/KG 1,296 (MEASURED) ĸ 0.00 DISCHARGE ENTHALPY 02 DISCHARGE CA 75.50 0.00 KG/SEC. 12.8 MG 0.190 CH4 0.00 MEASURED TEMPERATURE DEGREES C N2 0.0 C02 43.60 0.00 RESISTIVITY/TEMP. OHMM/DEG.C 0.0/ 0.0 \$04 34.70 MV/DEG.C 0.000/ 0.0 H2S 0.00 EH/TEMP+ CL 4308.00 LITERS GAS PER KG F 0.00 MEASURED DOWNHOLE TEMP. FLUID INFLOW DISS.SOLIDS CONDENSATE/DEG.C 11.50/25.0 0.00 0.0000 DEGREES C/METERS DEPTH (METERS) AL B 52,0000 0.0 FE 0.0000 CONBENSATE (PPM) 0+0 0.0 NH3 0.0000 PH/DEG.C 0.00/ 0.0 0.0 0.0 0.0 602 0.00 0.0 0.0 0.0 H2S 0.00 0.0 0.0 0.0 0.00 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 CONDENSATE WITH NAOH (PPM) 0.0 0.0 0.0 21599.00 0.0 0.0 C02 0+0 0.0 0.0 H2S 493.50 IGNIC BALANCE : CATIONS (MOL.EQ.)0,12987454 IONIC STRENGTH = 0,12865 ANIDNS (HOL.EQ.)0.12300957 DIFFERENCE (%) 5.43 DEEP WATER (PPM) DEEP STEAM (PPM) GAS PRESSURES (BARS ABS.) C02 0.126E+02 S102 501.10 C02 6509.85 C02 406004.66 H2S NA 1761,21 H2S 154.26 H2S 2911,42 0.116E+00 H2 0.00 H2 0.000E+00 H2 0.00 K 378.85 02 0.00 02 0.00 02 0.000E+00 CA 51.54 CH4 0,00 CH4 0.000E+00 0,130 CH4 0.00 MG N2 0,00 N2 0.000E+00 N2 0.00 \$04 23.69 NH3 0.000E+00 2940.56 NH3 0.00 NH3 0.00 CL. H20 0.755E+02 F 0.00 TOTAL 0+882E+02 DISS.S. 0,00 AL 0.0000 0.10 B 35,4940 H20 (Z)

BOILING PORTION

0.32

GAS SOLUBILITY MULTIPLYING FACTOR : 1.00

0.0000

FE

EPIDOTE

-40.420 99.999

MARCASITE

3.883 99.999

ACTIVITY (COEFFICIEN	TS IN DEEP WATER	1					
H÷	0.681	KS04-	0+620	FE	++	0.159	FECL+	0.589
OH-	0.576	F-	0.576	FE	+++	0.032	AL+++	0.032
H3SI04-	0.589	CL-	0,563	FE)H+	0.611	ALOH++	0.147
H2SI04	0.147	NAt	0.589	FE	(OH)3-	0.611	AL(0H)2+	0,620
H2B03-	0.550	K+	0.563	FE	(OH)4	0.140	AL(0H)4-	0.600
HC03-	0.589	CA++	0.159	FE	0H++	0,140	ALSO4+	0.600
003	0.130	MG++	0,197	FF	(0H)2+	0.620	AL (504)2-	0.600
HS-	0.574	COHCOZE	0.431	FF	(04)4-	0.620	AI F++	0.147
See	0.140	MCUCULT	A 500	EEG	HAL	0 411	ALCOL	0.400
9604-	0 400	CADAT	A 471	5 6 6	904T	0.140		0 4020
004	0.100	MONT	0.001	FE	2LTT 11 D L	0+140	MLF 'Y	0+000
304	0+120	NUMT	0+041	FEL	1.27	V+011	ALFO	0.130
NA204-	V+62V	NH4+	0.000	FE	,14-	0+387	ALF 6	0.010
CHENTRAL C	MENNENTE	TN DEED MATED /	DDM AND I DC Y	(01 E)				
UL ZACT N		5 774	2011 MAD LOUI	A 15	E 71A	FF/0017	A AA	A AAA
HT (ALI)	0.07	-3+3/4	nutt	VelZ	-0+31V	FE(UH)3	0.00	0.000
UH-	0+07	-5.408	NACL	5//+80	-2,005	FE(UH)4-	0.00	0.000
H4SI04	801+37	-2.079	KCL	46.81	-3,202	FECL+	0+00	0.000
H3SI04-	0,12	-5,882	NASO4-	4.07	-4+466	FECL2	0.00	0+000
H2SI04	0,00	-11.704	KS04-	7.24	-4.271	FECL++	0.00	0.000
NAH3SI04	0.08	-6.177	CAS04	3.62	-4,575	FECL2+	0.00	0,000
H3B03	202.96	-2.484	NGS04	0.02	-6.697	FECL3	0.00	0.000
H2B03-	0.05	-6+060	CAC03	0.02	-6+625	FECL4-	0.00	0.000
H2C03	9133.78	-0.832	MGCO3	0.00 -	-10.385	FES04	0.00	0.000
HC03-	25.81	-3.374	CAHC03+	24.90	-3,608	FES04+	0.00	0.000
C03	0.00	-9.014	MGHC03+	0.01	-7+098	AL+++	0.00	0.000
H2S	153.50	-2.346	CA0H4	0.02	-4.384		0.00	0.000
HC-	6.74	-4.450	NCUHT	0.01	-6.916	AL (0H) 24	0.00	0.000
6	0 00		MUANU	0,00	0,000	AL (DU) 7	0.00	0.000
U200A	V + VV	10 704	2014.1	0 00	0 00VV	AL (DU)A_	0.00	0.000
520U4	0100	-10:324	RE47	0.00	0.000	HE (UH) 9-	0+00	0,000
H504-	3+38	-4+256	1211	0+00	0.000	AL504+	0.00	0.000
504	1+30	-9,116	FE+++	0.00	0.000	AL(504)2	- 0.00	0.000
HF	0.00	0.000	FEOHt	0,00	0+000	ALF++	0.00	0.000
F-	0.00	0.000	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	2567.81	-1,140	FE(0H)3-	0.00	0.000	ALF3	0.00	0.000
NAt	1533.11	-1.176	FE(OH) 4	0.00	0.000	ALF4-	0.00	0.000
K+	352.20	-2.045	FE(OH)++	0.00	0.000	ALF5	0.00	0.000
CA++	40.57	-2.995	FE(0H)2+	0.00	0.000	ALF6	0.00	0.000
IONIC STRE	ENGTH = 0	+07660 IONI	C BALANCE :	CATIONS	(MOL.EQ.)	0.07797492		
				ANIONS	(MOL.EQ.)	0.07303931		
				DIFFEREN	ICE (%)	6.54		
CHEMICAL 0	EOTHERMON	ETERS DEGREES C		1000/T I	EGREES KE	LVIN = 1,77		
QUARTZ	256.2							
CHALCEDONY	999.9							
NAK	200.9							
11111	00040							
NUTTONTYON	POTENTIA	(UN TS) !	FH H28= -0.47	70 EH (HA= 99.99	9 FH H2= 99	.999 FH NH	3= 99.999
DATER 1104	FUIERITHE	(VUL107 +	CH 1/20- 9997	V LIL	117- 77977	/ 611 116- 77	•777 En fu	W. 779777
เกิด รถเปลา	TTY PROD	HETS OF MINERALS	IN DEEP MATE	R				
www.www.wata	TEO	R. CALC.	art sume will	TEOR	CALC		TEOR	CALC.
ATEL APTA	-14 4	A1 00.000	AL RITE LOU	-17.091	00.000	ANAL CTHE	-11,649	99,999
ANDADALLE	-0.0	72 .0 070	CAL PITE	-17 050	-17 40/	CHQI LEDU	NY -1.845	-2.079
WRITING TE	-0+0	/0 ~6+000 64 00 000	CHEGITE	-13+030	0 00 004		A 19072	00 000
MG-CHLURI	E -88.5	VI 77.777	FLOORITE	-11,172	2 77 • 77 ·	BUEINTIE	9+027	77+777
LAUMONTITE	-25.0	08 99.999	MICROCLINE	-14.97	99,999	MAGNETITI	-12.857	77 . 777
CA-MONTMOR	72.5	49 99.999	K-MONTMOR.	-33.72	99,999	MG-MONTM	UR -74.053	99,999
NA-MONTMOR	34.0	10 99.999	MUSCOVITE	-17,848	99.999	PREHNITE	-38.906	99+999
PYRRHOTITE	2,5	78 99.999	PYRITE	-11.641	99,999	QUARTZ	-1,943	-2.079
WAIRAKITE	-25,4	68 99,999	WOLLASTONITE	6+831	4.876	ZOISITE	-40+023	99,999

ORKUSTOFNUN JHD GEDCHEMISTRY OF WELL OKOY-10D 1982-11-12 OLIVER 222222222228105302222 OK0Y-10D S.NEGROS, PHILIPPINES PUHAGAN PROGRAM WATCH1. WATER SAMPLE (PPM) STEAM SAMPLE PH/DEG.C REFERENCE TEMP. DEGREES C 259.0 (MEASURED) 6+69/25+0 GAS (VOL+%) SI02 717+00 C02 0.00 NA 3167.00 H2S 0.00 SAMPLING PRESSURE BARS ABS. 2.6 H2 DISCHARGE ENTHALPY MJOUL/KG 1,313 (MEASURED) K 0.00 634.00 50.3 CA 122,00 02 0.00 DISCHARGE KG/SEC. 0.850 CH4 MG 0.00 MEASURED TEMPERATURE DEGREES C C02 2.60 N2 0.00 0.0 RESISTIVITY/TEMP+ OHMM/DEG+C 0.0/ 0.0 S04 51.50 H2S 0.00 EH/TEMP + MV/DEG.C 0.000/ 0.0 CL 5424.00 0.00 LITERS GAS PER KG F MEASURED DOWNHOLE TEMP, FLUID INFLOW DISS.SOLIDS 0.00 CONDENSATE/DEG.C 3.76/25.0 DEGREES C/METERS DEPTH (METERS) AL 0.0000 B 76,1000 0.0000 CONDENSATE (PPM) 0.0 0.0 0.0 FE 0.0 0.0 0.0000 PH/BEG.C 0.00/ 0.0 0.0 NH3 0.0 0.0 0.0 C02 0.00 H2S 0.00 0.0 0.0 0.0 NA 0.00 0.0 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 0.0 0.0 C02 7079.00 0.0 0.0 H2S 165.80 IONIC STRENGTH = 0.16024 IONIC BALANCE : CATIONS (MOL.E0.)0.15971066 ANIONS (MOL, EQ.)0.15369166 DIFFERENCE (%) 3.84 DEEP STEAN (PPH) GAS PRESSURES (BARS ABS.) DEEP WATER (PPM) C02 0.405E+00 SI02 519.39 C02 168.08 C02 21418.91 H2S H2S 442,03 H2S 0.108E-01 11.32 NA 2293,94 K 459.20 H2 0.00 H2 0.00 H2 0+000E+00 0.000E+00 88.37 02 0.00 02 0.00 02 CA CH4 CH4 CH4 0.000E+00 0.00 0.00 MG 0.616 N2 \$84 37.30 N2 0.00 N2 0.00 0.000E+00 NH3 0.00 NH3 0.000E+00 CL 3928.42 NH3 0.00 H20 0.462E+02 F 0.00 TOTAL 0,466E+02 DISS.S. 0.00 0.0000 AL H20 (%) 11.07 B 55,1162 BOILING PORTION 0.28 FE 0.0000

IN 0.694 F.S04- 0.530 FE++ 0.174 FEUL+ 0.577 DH- 0.594 F- 0.530 FEH+ 0.633 RL++ 0.037 DH- 0.577 CL- 0.570 FEUHH 0.621 RL(DH)2 0.630 H2033- 0.535 K + 0.570 FEUHH 0.621 RL(DH)2 0.630 HC03- 0.597 CA++ 0.174 FEUH 0.633 RLF++ 0.160 HC03- 0.597 CA++ 0.172 FEUH4 0.633 RLF++ 0.161 S03- 0.512 MBHD013+ 0.642 FEUH4 0.621 RLF2+ 0.630 B04- 0.130 MBH+ 0.555 FEUL4 0.527 RLF4- 0.611 RLF2+ 0.630 B04- 0.130 MBH 0.457 4.428 FEUL4 0.517 RLF4- 0.00 0.000 RS04- 0.130 MBH 0.427 FS124 0.527 <th>ACT10177 0</th> <th>OFFFICTO</th> <th>TO TH DEED HATE</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	ACT10177 0	OFFFICTO	TO TH DEED HATE						
HP 0.699 PEH+ 0.174 FELL 0.079 HSIGH- 0.591 CL- 0.570 FEOH 0.621 ALOH+ 0.111 MSIGH- 0.577 CL- 0.570 FEOH 0.621 ALOH+ 0.121 MSIGH- 0.577 CL+ 0.570 FEOH 0.621 ALOH+ 0.141 MG10- 0.597 CA+ 0.174 FEOH 0.432 ALOHA 0.409 MC3- 0.141 M6H 0.214 FEC(M14- 0.430 ALISDA/2 0.409 MS- 0.132 MGM02H 0.577 FEEMH 0.633 ALF+ 0.161 MS 0.130 MSGM- 0.462 FECL+ 0.512 ALF+ 0.612 MH4 0.555 FEL4 0.577 ALEA 0.600 0.000 DA 0.030 -55.231 MGL 373.55 -2.122 HECMH 0.000 0.000 DA 1.601 -5.771	ACTIVITY	UEFFICIEN	IS IN DEEP WATER	() () () () () () () () () ()		DUUK	1211 (1992)11211	2012/10-10-1	
DH- 0.584 F- 0.584 F- 0.584 F-H+ 0.037 HL+H 0.037 HL+H 0.131 HST0A- 0.1577 CL- 0.570 FE0H 0.621 HL0H+ 0.131 HST0A- 0.587 K 0.570 FE0H+ 0.621 HL0H+0.151 HST0A- 0.585 K 0.570 FE0H+4- 0.152 AL0H+0.609 HC03- 0.597 CA+H 0.174 FE0H+4 0.152 AL0H+0.609 HC03- 0.597 CA+H 0.174 FE0H+4 0.453 AL0F+2 0.609 HC03- 0.597 CA+H 0.174 FE0H+4 0.453 AL0F+2 0.609 HC03- 0.181 MH+H 0.216 FECH12+ 0.453 AL0F+2 0.609 HC03- 0.192 MHC03+ 0.442 FECH+4 0.453 AL0F+2 0.459 HC04- 0.130 MH+ 0.452 FECL+4 0.152 AL7+4 0.459 HC04- 0.130 MH+ 0.452 FECL+4 0.152 AL7+ 0.459 HC04- 0.130 MH+ 0.452 FECL+4 0.557 AL7+ 0.409 HC04- 0.130 MH+ 0.452 FECL+4 0.557 AL7+ 0.400 HC04- 0.040 5.573 MH+ 0.555 FECL+4 0.577 AL75 0.141 MH504- 0.30 MH+ 0.452 FECL+4 0.557 AL75 0.141 HS04+ 0.407 ST35 S -2.172 FECH+4 0.00 0.000 HS104 830.50 -2.463 KCL 36.58 -2.172 FECH+4 0.00 0.000 HS104- 0.19 -5.779 MH504 7.70 -4.191 FECL2 0.00 0.000 HS104- 0.11 -5.43 CK04 8.41 -4.197 FECL+4 0.00 0.000 HS104- 0.14 -5.13 CK00H 8.41 -4.197 FECL+4 0.00 0.000 HS104 0.14 -5.132 CK00H 8.41 -4.197 FECL+4 0.00 0.000 HS104 0.14 -5.132 CK00H 8.41 -4.197 FECL2 0.00 0.000 HC03- 0.08 -5.822 CA03 0.00 -7.951 FECL 0.00 0.000 HC03- 0.08 -5.822 CA03 0.00 -7.951 FECL3 0.00 0.000 HC03- 1.26 -4.468 CA4034 1.40 -4.800 FEED+4 0.00 0.000 HC03- 1.26 -1.468 CA4034 1.40 -4.800 FEED+4 0.00 0.000 HC03- 1.26 -4.468 CA4034 1.40 -4.800 FEED+4 0.00 0.000 HC03- 1.26 -1.468 CA4034 1.40 -4.800 FEED+4 0.00 0.000 HC03- 1.26 -1.468 CA4034 1.40 -4.800 FEED+4 0.00 0.000 HC03- 1.26 -1.468 CA4034 HH+4 0.00 0.000 ALC80+2 -0.00 0.000 HC03- 1.26 -1.468 CA4034 HH+4	H÷	0+694	KS04-	0.630	F	E++	0.174	FECL+	0,597
HSS104- 0.577 CL- 0.570 FEDH 0.421 ALOH+ 0.111 HSS104- 0.577 FC(M13- 0.421 ALOH+ 0.430 H203- 0.555 K4 0.570 FE(M13- 0.421 ALOH+ 0.430 H203- 0.597 C4+ 0.174 FE0H+ 0.152 ALOH+ 0.409 HC03- 0.597 C4+ 0.174 FE0H+ 0.152 ALOH+ 0.409 HC03- 0.597 C4+ 0.174 FE0H+ 0.430 ALISU42- 0.469 HS- 0.152 HOH03+ 0.442 FE(H)+ 0.430 ALISU42- 0.469 HS- 0.152 HOH03+ 0.442 FE(L)+ 0.430 ALISU42- 0.469 HS- 0.400 CANH 0.442 FE(L)+ 0.431 ALISU42- 0.469 HS04- 0.400 CANH 0.442 FE(L)+ 0.152 ALF4- 0.459 HS04- 0.400 HOH03+ 0.555 FE0L+ 0.421 ALF4- 0.469 HS04- 0.430 HOH0 0.452 FE(L)+ 0.152 ALF4- 0.469 HS04- 0.430 HOH 0.452 FE(L)+ 0.577 ALE8- 0.1141 HA034- 0.430 HOH 0.452 FE(L)+ 0.577 ALE8- 0.1141 HA034- 0.450 HOH 0.442 FE(L)+ 0.577 ALE8- 0.000 0.000 HC101 -5.721 HOH 0.555 FE0L+ 0.977 ALF6 0.012 CHENICAL COMPONENTS IN HEF WATER (PM AMD LOB MOLE) H4 (ACT.) 0.01 -5.721 HOH 0.575 -2.172 FE(DH)4- 0.00 0.000 HS104 83.550 -2.463 KCL 336.48 -3.305 FE(L)+ 0.00 0.000 HS104- 0.05 -5.523 HACL 375.75 -2.172 FE(DH)4- 0.00 0.000 HS104- 0.14 -5.971 KB04 0.19 -5.801 FE(L) 0.00 0.000 HS104- 0.00 -11.330 KS04+ 7.479 -4.233 FE(L)+ 0.00 0.000 HS1050 -0.00 -10.48 ALI -7.90 -4.233 FE(L)+ 0.00 0.000 HS1050 -0.00 -7.905 FE(L)+ 0.00 0.000 HS1050 315.17 -2.733 HB054 0.19 -5.801 FE(L) 0.00 0.000 HS203 234.63 -2.422 H6003 0.00 -11.119 FESD4 0.00 0.000 HC203 234.63 -2.422 H6003 0.00 -17.975 FE(L)+ 0.00 0.000 HC203 234.63 -2.422 H6003 0.00 -17.977 ALCH+ 0.00 0.000 HC203 1.22 -4.468 CAOHH 0.02 -6.7879 ALCH1+ 0.00 0.000 HC203 1.22 -4.468 CAOHH 0.02 -6.7879 ALCH1+ 0.00 0.000 HC204 1.45 -4.468 CAOHH 0.00 -1.6760 ALCH1+ 0.00 0.000 HC204 0.468 +4.46 -4.337 FE(H) 0.00 0.000 ALCH1+ 0.00 0.000 HC204 0.00 -10.458 HM4H 0.00 0.000 ALCH1+ 0.00 0.000 HC204 0.00 FE0H+ 0.00 0.000 ALCH1+ 0.00 0.000 HC204 0.000 FE0H+ 0.00 0.000 ALCH1+ 0.00 0.000 HC44 4.46 -4.337 FE(H) 0.00 0.000 ALF5 0.00 0.000 HC44 4.46 -4.337 FE(H) 0.00 0.000 ALF5 0.00 0.000 HC44 0.46 -4.337 FE(H) 0.00 0.000 ALF5 0.00 0.000 HC44 0.468 -9.9999 HENCEL HOH05 (MUEES KELVIH = 1.88 HUND	0H	0,584	F-	0.584	F	E+++	0.039	AL+++	0.039
R28104 0.161 M44 0.597 FE(CMH 4 0.121 AL(CM)24 0.333 R2003 0.555 K + 0.570 FE(CMH 4 0.152 ALGM 4- 0.609 MC03 0.141 M6H+ 0.216 FE(CMH 4 0.432 ALSM 4- 0.609 BS- 0.534 CAMC03F 0.442 FE(CMH 4 0.630 ALTSM 4- 0.161 S 0.152 MEMO2F 0.577 FESDA+ 0.621 ALF2+ 0.633 B04 0.609 COMH 0.642 FECL4+ 0.152 ALFA 0.609 S04 0.130 M6MH 0.552 FECL4+ 0.577 ALFA 0.601 CHERICAL COMPONENTS IN MEER (PM AMD LOB MOLE) H MC37 ALFA 0.600 M141 MS104 0.16 -5.723 MADL 373,55 -2.172 FE(CM13 0.00 0.000 MS104 0.14 -5.719 MAB04 7,67 -4.123 FE(CL4- </td <td>H3SI04-</td> <td>0.597</td> <td>CL-</td> <td>0.570</td> <td>FI</td> <td>EOH+</td> <td>0.621</td> <td>ALOH++</td> <td>0.161</td>	H3SI04-	0.597	CL-	0.570	FI	EOH+	0.621	ALOH++	0.161
H2D3- 0.555 K4 0.570 FE(OH)4 0.152 AL(OH)4- 0.609 HC3- 0.597 CAH 0.114 FE(OH)2+ 0.630 AL(SD4)2- 0.609 HS- 0.152 HEMC3+ 0.642 FE(OH)2+ 0.630 AL(SD4)2- 0.609 HS 0.152 HEMC3+ 0.642 FE(OH)2+ 0.630 AL(FA+ 0.630 HS04- 0.630 CADH 0.642 FECL+ 0.521 ALFA- 0.609 S04 0.630 MH4+ 0.555 FECL+ 0.621 ALFA- 0.609 CH4 0.630 MH4+ 0.555 FECL+ 0.621 ALFA- 0.609 CH4 0.612 HE HE 0.555 FECL+ 0.60 0.000 CH4 0.615 5.23 MACL 36,58 -3.305 FECL+ 0.00 0.000 HS104 0.19 -5.79 MAS2 MACA 7.4191 FECL9 0.00 0.000 HS104 0.19 -5.797 MADA 4.4199 F	H2SI04	0.161	NA+	0,597	F	E(OH)3-	0.621	AL(0H)2+	0.630
HC03 0.597 C4++ 0.174 FE0H++ 0.152 HC04++ 0.409 BG3 0.154 CAHC03+ 0.442 FE(0H)2+ 0.630 AL1504)2- 0.609 BG4 0.594 CAHC03+ 0.442 FECUH+ 0.152 AL74- 0.630 BG4- 0.609 COMH 0.442 FECUH+ 0.152 AL74- 0.609 BG4- 0.630 MEMU3+ 0.652 FECL4+ 0.152 AL74- 0.609 CHENICAL COMPONENTS IN BEEP MATER (PPN AHD LOS MOLE) H 4.677. -4.628 FE(0H)- 0.00 0.000 CHA150 0.01 -5.723 HADL 37.355 -2.172 FE(0H)- 0.00 0.000 CH310+ 0.19 -5.801 FECL2 0.00 0.000 H3314 0.11 FECL2 0.00 0.000 RASID4 0.14 -5.733 H6804 0.19 -5.801 FECL3 0.00 0.000 RASID4 0.14 -5.	H2B03-	0.555	K+	0.570	FI	E(OH)4	0.152	AL(0H)4-	0.609
033 0.141 MGH 0.216 FECUN124 0.635 ALTGDA12- 0.609 HS 0.534 CANCD37 0.442 FECUN124- 0.635 ALTGA12- 0.609 HS 0.522 MENDUG4+ 0.642 FECUH124- 0.630 ALTA- 0.609 HS04 0.630 CADH 0.642 FECL4+ 0.572 ALTA- 0.609 HS04 0.630 MH4+ 0.555 FECL4- 0.597 ALTA- 0.609 CHE- 0.013 MGH4 0.555 FECL4- 0.597 ALTA- 0.609 MS04- 0.630 MH4+ 0.555 FECL4- 0.597 ALTA- 0.609 MS104- 0.61 -5.71 MB4+ 0.57 -4.628 FECUH13 0.00 0.000 MS104- 0.69 -5.801 FECL4- 0.00 0.000 RS104- 7.79 -4.191 FECL2+ 0.00 0.000 RS033 S1.71 -2.273	HC03-	0.597	CA++	0.174	F	FOH++	0.152	AL SO4+	0.609
0.00 0.1534 CARD33 0.242 FE(0H)4- 0.630 ALLSP/Z 0.630 5 0.152 HERCO34 0.577 FESDA4 0.621 ALE2+ 0.633 50 0.152 HERCO34 0.577 FESDA4 0.621 ALE2+ 0.633 504 0.130 MORH4 0.652 FEEL2+ 0.621 ALE5 0.121 CHEMICAL COMPORENTS IN DEEP WATER (PPH AND LOG MOLE) H (ACT) 0.01 -5.5.23 MACL 373,55 -2.172 FEC0H)4- 0.00 0.000 CH-40.05 -5.5.23 MACL 373,55 -2.172 FEC0H)4- 0.00 0.000 M3104 0.13 -5.709 MASD4- 7.67 -4.123 FECL+ 0.00 0.000 M3104 0.14 -5.713 GASD4 7.67 -4.233 FECL+ 0.00 0.000 M3104 0.14 -5.713 GASD4 7.61 -FEL2+ 0.00 0.000 M3104	03	0.141	MGLA	0.214	FI	E/04124	0.430	AL (S0A)2-	0.409
DD D1000 D10000 D100000 <thd10000< th=""> <thd10000< th=""></thd10000<></thd10000<>	uc_	0.504	CAUC023	0 440	51	E(04)A_	0 470	V) CTT	A 141
ST 0.122 PHOLOGY 0.377 PESNET 0.621 RELEF 0.630 B04- 0.300 MSOH 0.632 FEDL+H 0.152 ALFA- 0.609 B04- 0.330 MSOH 0.652 FEDL+H 0.512 ALFA- 0.101 CMEMICAL COMPONENTS IN BEEP WATER (PPH AND LOB MOLE) H V V V V 0.000 0.000 CMENICAL COMPONENTS IN BEEP WATER (PPH AND LOB MOLE) H V V V 0.000 0.000 0.000 VMSID4 0.01 -5.733 MACL 357.55 -2.172 FE(H)+A 0.00 0.000 VMSID4 0.19 -5.733 MAGD4 7.47 -4.191 FELL2 0.00 0.000 VMSID4 0.11 -5.733 MS04- 0.423 FELL+ 0.00 0.000 VMSID4 0.41 -5.713 MS04- 7.90 -4.233 FELL+ 0.00 0.000 VEB03 0.06 -5.733 <td< td=""><td>no-</td><td>V+J07</td><td>WELLED Z L</td><td>V+012</td><td></td><td>C(UN74-</td><td>0+03V A (31</td><td>MUEDI</td><td>V+101 0 /70</td></td<>	no-	V+J07	WELLED Z L	V+012		C(UN74-	0+03V A (31	MUEDI	V+101 0 /70
RNAT 0.007 DUNT 0.012 PELLT 0.132 PELTS 0.132 PELTS 0.131 MASGA 0.330 MHAH 0.552 FECL24 0.521 ALFS 0.012 CHEMICAL COMPONENTS IN DEEP WATER (PPH AND LOG HOLE) H 0.01 0.000 0.000 0.000 MASIDA 0.10 -5.771 M6H 0.37 -4.628 FE(0H)3 0.000 0.000 MASIDA 0.10 -5.772 M6BOA- 7.67 -4.191 FEELL 0.00 0.000 MSIDA 0.10 -5.732 M6BOA- 7.67 -4.191 FEELL 0.00 0.000 MSIDA 0.14 -5.732 M6BOA 0.17 -5.801 FECL4 0.00 0.000 MSIDA 0.14 -5.732 M6BOA 0.17 -5.801 MCL24 0.00 0.000 MASIDA 0.14 -5.732 MAGAH 0.00 -1.111 FEEDA 0.00 0.000 MCD3	0	0 /00	DORLUST	0+37/	F1	10047	V+0Z1	MLFZT	0.000
SU4	nau4-	V+0V7	LAUNT	0+042	FI		0,132	ALF 4-	0.607
MNBUA+ 0.430 MM14 0.555 FEELA+ 0.597 ALF6 0.012 CHEMICAL COMPONENTS IN DEEP WATER (PPH AND LOG MOLE) H 4.057 -4.628 FE(0H)3 0.00 0.000 CH+ 0.01 -5.271 MH14 0.57 -4.628 FE(0H)4- 0.00 0.000 MH3104 830.50 -2.063 MCL 337.855 -2.172 FE(0H)4- 0.00 0.000 MS104- 0.19 -5.779 MAS04- 7.47 -4.191 FEL2 0.00 0.000 MS104- 0.14 -5.793 MAS04 7.47 -4.191 FEL2 0.00 0.000 MS103 0.11 -5.812 CAC03 0.00 -11.119 FEDL4 0.00 0.000 MS104- 0.42 -4.686 CAMC033 1.40 -1.480 0.00 0.000 MC03- 1.26 -4.486 CAMC034 1.60 -4.694 0.00 0.000 MC3- 1.424 0.40 0.00 -2.6377 ALIGH+4 0.00 0.000 MC3- </td <td>504</td> <td>0.130</td> <td>MGUHT</td> <td>0.652</td> <td>1</td> <td>-UL2+</td> <td>0.621</td> <td>ALF 5</td> <td>0+141</td>	504	0.130	MGUHT	0.652	1	-UL2+	0.621	ALF 5	0+141
CHEMICAL COMPONENTS IN DEEP WATER (PPH AND LOG HOLE) H+ (ACT.) 0.01 -5.221 M0H+ 0.57 -4.628 FE(OH)3 0.00 0.000 DH- 0.05 -5.528 NACL 334,98 -21.72 FE(OH)4- 0.00 0.000 H/SI04 830.50 -2.063 KCL 36.98 -3.305 FECL+ 0.00 0.000 H/SI04 0.19 -5.799 NASD4- 7.67 -4.191 FECL2 0.00 0.000 NAH3SID4 0.14 -5.913 CASD4 0.42 -7.67 -4.191 FECL2 0.00 0.000 NAH3SID4 0.14 -5.913 CASD4 0.19 -5.801 FECL4 0.00 0.000 NAH3SID4 0.14 -5.913 CASD4 0.19 -5.801 FECL4 0.00 0.000 H/2033 315.17 -2.793 M65D4 0.19 -5.801 FECL4 0.00 0.000 H/2033 234.63 -2.422 NECO3 0.00 -7.905 FECL4 0.00 0.000 H2033 1.26 -4.66 CAMCD34 1.60 -4.800 FESD4 0.00 0.000 H203 1.26 -4.66 CAMCD34 1.60 -4.800 FESD4 0.00 0.000 H22 11.21 -3.483 CADH+ 0.02 -6.377 AL1+4 0.00 0.000 H25 11.21 -3.483 CADH+ 0.02 -6.377 AL1+4 0.00 0.000 H25 11.21 -3.483 CADH+ 0.00 0.000 AL(OH)2 0.00 0.000 H25 11.21 -3.483 CADH+ 0.00 0.000 AL(OH)2 0.00 0.000 H25 11.21 -3.483 CADH+ 0.00 0.000 AL(OH)2 0.00 0.000 H26 0.11 -5.740 HIGH0 0.01 -6.760 AL(OH)2 0.00 0.000 H25 0.00 -14.534 MH40H 0.00 0.000 AL(OH)2 0.00 0.000 H25 0.00 -14.637 FEL+ 0.00 0.000 AL(OH)2 0.00 0.000 H26 0.00 0.000 FECH4 0.00 0.000 AL(OH)2 0.00 0.000 H50 0.00 0.000 FECH4 0.00 0.000 ALE74 0.00 0.000 H50 0.00 0.000 FECH4 0.00 0.000 ALE74 0.00 0.000 H6 0.00 0.000 FECH12 0.00 0.000 ALF3 0.00 0.000 H4 2137.61 -1.032 FE(OH)3- 0.00 0.000 ALF3 0.00 0.000 H4 2137.61 -1.032 FE(OH)4- 0.00 0.000 ALF3 0.00 0.000 H4 4 237.52 -1.951 FE(OH)2 0.00 0.000 ALF3- 0.00 0.000 H4 4 237.52 -1.951 FE(OH)2 0.00 0.000 ALF3- 0.00 0.000 H4 4 85.18 -2.673 FE(OH)2 0.00 0.000 ALF5 0.00 0.000 H4 4 237.52 -1.951 FE(OH)2 0.00 0.000 ALF6 0.00 0.000 H4 4 237.52 -1.951 FE(OH)2 0.00 0.000 ALF6 0.00 0.000 H4 237.51 -1.032 FE(OH)4 0.00 0.000 ALF6 0.00 0.000 H4 4 37.52 -1.951 FE(OH)2 0.00 0.000 ALF6 0.00 0.000 H4 4 437.52 -1.951 FE(OH)2 0.00 0.000 ALF6 0.00 0.000 H4 4 437.52 -1.951 FE(OH)2 0.00 0.000 ALF6 0.00 0.000 H5 0.000 0.000 FECH14 0.000 0.000 ALF6 0.00 0.000 H5 0.000 0.000 FECH14 0.000 0.000 ALF6 0.00 0.000 H5	NASU4-	0.630	MH4 +	0.555	F	ECL4-	0.577	ALF6	0.012
H+ (ACT.) 0.01 -5.271 HG++ 0.57 -4.628 FE(DH)3 0.00 0.000 CH- 0.05 -5.528 HACL 373.55 -2.172 FE(DH)4- 0.00 0.000 H45104 03.50 -2.403 KCL 34.98 -3.305 FECL 4 0.00 0.000 H45104 0.19 -5.799 HA504- 7.47 -4.191 FECL2 0.00 0.000 H25104- 0.00 -11.330 KS04- 7.90 -4.233 FECL+ 0.00 0.000 H25303 315.17 -2.293 H6504 0.19 -5.801 FECL3 0.00 0.000 H2803 0.08 -5.882 CACD3 0.00 -7.905 FECL4 0.00 0.000 H2803 0.08 -5.882 CACD3 0.00 -7.905 FECL4 0.00 0.000 H203 234.63 -2.422 H6C03 0.00 -71.119 FESU4 0.00 0.000 HC03 - 1.26 -4.686 CAHCD3+ 1.60 -4.800 FESU4+ 0.00 0.000 H25 11.21 -3.483 CA0H 0.02 -6.377 AL0H+ 0.00 0.000 H25 11.21 -3.483 CA0H 0.02 -6.377 AL0H+ 0.00 0.000 H25 11.21 -3.483 CA0H 0.01 -6.760 AL(DH)2 + 0.00 0.000 H25 11.21 -3.483 CA0H 0.00 -0.000 AL(DH)3 0.00 0.000 H25 11.21 -3.483 CA0H 0.00 -0.000 AL(DH)4 0.00 0.000 H25 11.21 -3.483 CA0H 0.00 -0.000 AL(DH)4 0.00 0.000 H25 11.21 -3.483 CA0H 0.00 -6.377 AL0H+ 0.00 0.000 H25 11.21 -3.483 CA0H 0.00 -0.000 AL(DH)4 0.00 0.000 H25 0.00 -10.469 NH44 0.00 0.000 AL(DH)4 0.00 0.000 H26 0.00 -10.469 NH44 0.00 0.000 AL(DH)4 0.00 0.000 H26 0.00 -10.69 S FE(DH)2 0.00 0.000 AL(DH)4 0.00 0.000 H50 - 4.465 -3.811 FE++ 0.00 0.000 AL(DH)4 0.00 0.000 H50 - 4.465 -3.811 FE++ 0.00 0.000 AL(DH)4 0.00 0.000 H50 - 4.465 -3.811 FE++ 0.00 0.000 ALCH14 0.00 0.000 H50 - 4.435 -3.811 FE++ 0.00 0.000 ALF4 0.00 0.000 H50 - 4.435 -3.811 FE++ 0.00 0.000 ALF4 0.00 0.000 H50 - 4.435 -3.811 FE++ 0.00 0.000 ALF4 0.00 0.000 H6 - 0.00 0.000 FE(DH)2 0.00 0.000 ALF4 0.00 0.000 H6 - 0.000 0.000 FE(DH)2 0.00 0.000 ALF4 - 0.00 0.000 H6 - 0.00 0.000 FE(DH)2 0.00 0.000 ALF4 - 0.00 0.000 H6 - 0.00 0.000 FE(DH)2 0.00 0.000 ALF4 - 0.00 0.000 H6 - 0.1035 FE(DH)2 0.00 0.000 ALF4 - 0.00 0.000 H6 - 0.1035 FE(DH)2 0.00 0.000 ALF4 - 0.00 0.000 H6 - 0.1035 FE(DH)2 0.00 0.000 ALF4 - 0.00 0.000 H6 - 0.000 0.000 FE(DH)4 0.00 0.000 ALF4 - 0.00 0.000 H6 - 0.000 0.000 FE(DH)4 0.00 0.000 ALF4 - 0.00 0.000 H6 - 0.1035 FE(DH)2 0.00 0.000 ALF4 - 0.00 0.000 H6 - 0.1035 FE(DH)2 0.00 0.000 ALF4 - 0.00 0.00	CHEMICAL C	OMPONENTS	IN DEEP WATER (PPH AND LOG M	OLE)				
DH- 0.05 -5.23 MHCL 393.95 -2.172 FE(DH)- 0.00 0.000 MASID4 830.50 -2.063 KCL 36.98 -3.305 FECL+ 0.00 0.000 MASID4 0.19 -5.709 MASD4- 7.67 -4.191 FECL+ 0.00 0.000 MASD4 0.47 -4.031 FECL+ 0.00 0.000 MASD4 MASD4 0.41 -5.713 CASD4 B.61 -4.199 FECL+ 0.00 0.000 MASD3 0.08 -5.822 CACD3 0.00 -7.905 FECL4 0.00 0.000 MCD3 1.26 -4.686 CAMCD3+ 1.60 -4.800 FECL4 0.00 0.000 M2203 234.63 -2.422 MECD3 0.00 -7.877 ALCHH 0.00 0.000 0.000 M2204 0.10 -14.634 MBCH4 0.01 -6.760 ALCH14 0.00 0.000 MCD3 -0.00 <td>H4 (ACT.)</td> <td>0.01</td> <td>-5.971</td> <td>KG++</td> <td>0.57</td> <td>-4.628</td> <td>FF(OH)3</td> <td>0.00</td> <td>0.000</td>	H4 (ACT.)	0.01	-5.971	KG++	0.57	-4.628	FF(OH)3	0.00	0.000
DD 0 000 000 000 0000 0000 0000 0000 0	ON-	0.05	-5 570	NAM	707 55	-7 172	FE(OU)A_	0,00	0.000
MTS104 53.78 -24.003 ML 35.78 -34.003 FELL+ 0.00 0.000 MTS104 0.19 -5.779 MAG044 7.67 -4.191 FELL2 0.00 0.000 MAH3S104 0.14 -5.913 CAS04 8.61 -4.193 FELL4 0.00 0.000 MABS104 0.14 -5.913 CAS04 8.61 -4.193 FELL4 0.00 0.000 M2003 1.26 -4.686 CAC03 0.00 -7.905 FELL4 0.00 0.000 HC03 1.26 -4.686 CAMC034 1.60 -7.800 FES044 0.00 0.000 RE- 0.11 -5.744 M6H0H 0.00 -7.675 ALDH4 0.00 0.000 SE4 0.00 -14.534 MH40H 0.00 -0.00 ALC0H12 0.00 0.000 SE4 0.46 -4.337 FE1+ 0.00 0.000 ALC0H14 0.00 0.000 SE04 0.46 -0.00 0.000 FE1H 0.00 0.000 AL	UN-	070 60	-3+320	NHUL	373+33	-241/2	re(un)4-	0.00	0.000
HSS104- 0.04 - 0.07 -0.709 MA804- 7.67 -4.191 FECL2 0.00 0.000 MA3BID4 0.04 -5.913 CAS04 8.61 -4.199 FECL4+ 0.00 0.000 MA43SID4 0.14 -5.913 CAS04 8.61 -4.199 FECL2+ 0.00 0.000 H2B03- 0.08 -5.822 CAC03 0.00 -7.905 FECL4- 0.00 0.000 H2C03 234.63 -2.422 M6C03 0.00 -11.119 FES04 0.00 0.000 H2C03- 1.26 -4.666 CAMC03+ 1.60 -4.800 FES04+ 0.00 0.000 H2C3- 1.26 -4.666 CAMC03+ 1.60 -4.800 FES04+ 0.00 0.000 H2C3 11.21 -3.483 CA0H+ 0.02 -6.397 ALDH+ 0.00 0.000 H2S 11.21 -3.483 CA0H+ 0.02 -6.397 ALDH+ 0.00 0.000 H2S 0.00 -10.064 M6HC34 0.00 -0.000 AL(0H)2+ 0.00 0.000 H2S 0.00 -10.469 MH4+ 0.00 0.000 AL(0H)3 0.00 0.000 H2S04 0.00 -10.469 MH4+ 0.00 0.000 AL(0H)3 0.00 0.000 HSG4 4.46 -4.337 FEL+ 0.00 0.000 AL(0H)4- 0.00 0.000 HSG4- 4.46 -4.337 FEL+ 0.00 0.000 AL(0H)2+ 0.00 0.000 HSG4- 4.45 -5.311 FEL+ 0.00 0.000 AL(2H)4- 0.00 0.000 HSG4- 4.45 -7.311 FEL+ 0.00 0.000 AL(2H)4- 0.00 0.000 HF 0.00 0.000 FECHH2 0.00 0.000 ALF1+ 0.00 0.000 HA 2137.61 -1.032 FE(0H)4 0.00 0.000 ALF2+ 0.00 0.000 HA 2137.61 -1.032 FE(0H)4 0.00 0.000 ALF4- 0.00 0.000 HA 4.2137.61 -1.032 FE(0H)2+ 0.00 0.000 ALF5 0.00 0.000 CA++ 85.18 -2.673 FE(0H)2+ 0.00 0.000 ALF5 0.00 0.000 CA++ 85.19 99.99 NAK 283.1 DXIDATION POTENTIAL (VOLTS) ! EH H29-90.99 FENDER TEDR. CALC. TEDR. CALC. TEDR. CALC. TEDR. CALC. 100.77 PEDR 20.77 99.999 NAK 283.1 DXIDATION POTENTIAL (VOLTS) ! EH H29-90.99 PN PH1TE 2.776	H45104	00+068	-2+063	NCL.	36+98	-3.305	FECLT	0.00	0.000
H23104	H3S104-	0+19	-2*108	NASU4-	7.67	-4.191	FECL2	0.00	0.000
MAH3BI04 0.14 -5.913 CA804 8.61 -4.199 FECL24 0.00 0.000 H3B03 315.17 -2.293 M6504 0.19 -5.801 FECL3 0.00 0.000 H2B03- 1.26 -4.686 CAHC034 1.60 -4.800 FESD44 0.00 0.000 H2D3- 1.26 -4.686 CAHC034 1.60 -4.800 FESD44 0.00 0.000 H2D3- 1.26 -4.686 CAHC034 1.60 -4.800 FESD44 0.00 0.000 H2D3- 1.26 -4.686 CAHC034 0.00 -7.879 AL1444 0.00 0.000 0.000 NL 0.00 0.000 NL 0.00 0.000 0.000 NL 0.00 0.000 NL NL 0.00 0.000 NL NL 0.00 0.000 <td>H2SI04</td> <td>0.00</td> <td>-11.380</td> <td>KS04-</td> <td>7,90</td> <td>-4.233</td> <td>FECL++</td> <td>0.00</td> <td>0.000</td>	H2SI04	0.00	-11.380	KS04-	7,90	-4.233	FECL++	0.00	0.000
H3B03 315.17 -2.273 H6504 0.19 -5.801 FEEL3 0.00 0.000 H2B03- 0.08 -5.882 CAC03 0.00 -7.905 FECL4- 0.00 0.000 H2C03 234.63 -2.422 H6C03 0.00 -11.119 FESD4 0.00 0.000 HC03- 1.26 -4.686 CAHC03+ 1.60 -4.800 FESD4 0.00 0.000 HC3- 0.00 -10.084 M6HC03+ 0.00 -7.679 AL+++ 0.00 0.000 H25 11.21 -3.483 CAOH+ 0.02 -6.377 ALOH+ 0.00 0.000 H25 0.0 -14.4534 NH40H 0.00 0.000 AL(0H)2+ 0.00 0.000 HS0- 0.01 -4.4534 NH40H 0.00 0.000 AL(0H)2+ 0.00 0.000 HS04- 4.46 -4.337 FE++ 0.00 0.000 AL(0H)4- 0.00 0.000 HS04- 4.46 -4.337 FE++ 0.00 0.000 AL(S01)2- 0.00 0.000 HS04- 4.46 -4.337 FE++ 0.00 0.000 AL(S01)2- 0.00 0.000 HS04- 14.85 -3.811 FE+++ 0.00 0.000 AL(S01)2- 0.00 0.000 HF 0.00 0.000 FE0H+ 0.00 0.000 AL(S01)2- 0.00 0.000 HF 0.00 0.000 FE0H+ 0.00 0.000 AL(S1)2- 0.00 0.000 HF 0.00 0.000 FE0H+ 0.00 0.000 AL(S1)2- 0.00 0.000 HA+ 2137.61 -1.032 FE(0H)3- 0.00 0.000 ALF2+ 0.00 0.000 HA+ 2137.61 -1.032 FE(0H)4 0.00 0.000 ALF3- 0.00 0.000 CL- 367.10 -0.985 FE(0H)3- 0.00 0.000 ALF3- 0.00 0.000 CL+4 85.18 -2.673 FE(0H)4 0.00 0.000 ALF5 0.00 0.000 CA++ 85.18 -2.673 FE(0H)2+ 0.00 0.000 ALF5 0.000 0.000 CA++ 85.19 -2.673 FE(0H)2+ 0.000 0.000 ALF5 0.000 0.000 CA++ 85.19 -2.673 FE(0H)2+ 0.000 0.000 ALF5 0.000 0.000 CA++ 85.09 PS99 ALBTE LON -13.941 99.999 AAACCHE -11.542 99.999 CA+00HM0R -34.97 99.999 ALBTE LON -13.941 99.999 AAACCHE -11.542 99.999 CA+00HM0R -34.97 99.99	NAH3SI04	0.14	-5,913	CAS04	8+61	-4.199	FECL2+	0.00	0.000
H2B03- 0.08 -5.882 CAC03 0.00 -7.905 FECL4- 0.00 0.000 H2C03 234.63 -2.422 MEC03 0.00 -11.119 FESD4 0.00 0.000 H2C03- 0.00 -10.084 MEC034 0.00 -7.879 ALHH 0.00 0.000 H2S 11.21 -3.483 CAOHH 0.02 -6.397 ALHH 0.00 0.000 H2S 11.21 -3.483 CAOHH 0.02 -6.397 ALHH 0.00 0.000 H2S 11.21 -3.483 CAOHH 0.01 -6.760 AL(OH)24 0.00 0.000 H2S 11.21 -3.483 CAOHH 0.00 0.000 AL(OH)3 0.00 0.000 H2S 11.21 -3.483 CAOHH 0.00 0.000 AL(OH)3 0.00 0.000 H2S 11.21 -3.483 CAOHH 0.00 0.000 AL(OH)3 0.00 0.000 H2S 11.21 -3.483 NH4H 0.00 0.000 AL(OH)3 0.00 0.000 H2S 1.1.25 -3.811 FEH 0.00 0.000 AL(OH)3 0.00 0.000 H2S - 0.00 0.000 FECH 0.00 0.000 AL(SOH - 0.00 0.000 HF 0.000 0.000 FECH 0.00 0.000 AL(SOH - 0.00 0.000 CL- 3672.10 -0.985 FE(OH)3- 0.00 0.000 AL(F1+ 0.00 0.000 CL- 3672.10 -0.985 FE(OH)3- 0.00 0.000 ALF3 0.00 0.000 H4 437.52 -1.951 FE(OH)4- 0.00 0.000 ALF3 0.00 0.000 K4 437.52 -1.951 FE(OH)4- 0.00 0.000 ALF3 0.00 0.000 K4 437.52 -1.951 FE(OH)4- 0.00 0.000 ALF5 0.00 0.000 CL+ 367.11 -0.02 FE(OH)4- 0.00 0.000 ALF5 0.00 0.000 H2 - 0.00 0.000 H2 - 0.00 0.000 H2 - 0.00 0.000 H2 - 0.00 0.000 ALF5 0.00 0.000 H2 - 0.000 - 0.000 H2 - 0.000 0.000 H2 - 0.000 - 0.000 H2 - 0.000 - 0.000 H2 - 0.000 H2 - 0.000 H2 - 0.000 - 0.000 H2 - 0.	H3B03	315.17	-2+293	MGSO4	0.19	-5,801	FECL3	0.00	0.000
H2C03 234,63 -2.422 H6C03 0.00 -11.119 FES04 0.00 0.000 HC03- 1.26 -4.686 CAHC034 1.60 -4.800 FES04 0.00 0.000 H2S 11.21 -3.483 CAOHH 0.02 -6.397 AL4HH 0.00 0.000 H2S 11.21 -3.483 CAOHH 0.02 -6.397 AL4HH 0.00 0.000 H2S 0.11 -5.494 H6OH4 0.01 -6.760 AL(0H)24 0.00 0.000 H2S04 0.00 -14.534 NH4OH 0.00 0.000 AL(OH)3 0.00 0.000 H2S04 0.00 -10.469 NH44 0.00 0.000 ALC0H)4 0.00 0.000 HS04 4.46 -4.337 FEH 0.00 0.000 ALC0H)4 0.00 0.000 HS04 4.46 -4.337 FEH 0.00 0.000 ALC0H)2- 0.00 0.000 HF 0.00 0.000 FE(0H)2 0.00 0.000 ALE04 HF 0.00 0.000 FE(0H)2 0.00 0.000 ALF7H 0.00 0.000 F- 0.00 0.000 FE(0H)2 0.00 0.000 ALF7H 0.00 0.000 K4 437.52 -1.951 FE(0H)3- 0.00 0.000 ALF3 0.00 0.000 K4 437.52 -1.951 FE(0H)3- 0.00 0.000 ALF3 0.00 0.000 K4 437.52 -1.951 FE(0H)24 0.00 0.000 ALF3- 0.00 0.000 CA+# 85.18 -2.673 FE(0H)24 0.00 0.000 ALF3- 0.00 0.000 CA+# 283.1 DIFFERENCE (X) 4.29 CHENICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 DUARTZ 259.9 CHENICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 DUARTZ 259.9 CHENICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.428 99.999 HAK 283.1 DIFFERENCE (X) 4.29 CHENICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.428 99.999 LOG SOLUBILITY PRODUCTS OF MINERALS IN BEEP WATER TEOR, CALC, TEOR, CALC, TEOR, CALC, TEOR, CALC, TEOR, CALC, ADULARIA -14.381 99.999 ALBITE LOH -13.941 99.999 ANALCINE -11.542 99.999 ANTOTHE -24.635 99.999 ALBITE LOH -13.941 99.999 ANALCINE -11.542 99.999 ANTOTHE -24.635 99.999 ALBITE LOH -13.941 99.999 ANALCINE -11.542 99.999 ANTOTHE -24.635 99.999 HICROLINE -13.028 99.999 MAGNETITE -16.058 99.999 PYRHOTITE -24.635 99.999 MICROLINE -13.028 99.999 MAGNETITE -16.058 99.999 PYRHOTITE -24.635 99.999 MICROLINE -35.069 99.999 MAGNETITE -16.058 99.999 PYRHOTITE -15.934 99.999 PYRTE -37.629 99.999 PYRHOTITE -15.934 99.999 PYRTE -37.629 99.999 PYRHOTITE -15.934 99.999 PYRTE	H2B03-	0.08	-5.382	CAC03	0.00	-7,905	FECL4-	0.00	0.000
HC03- 1.26 -4.686 CAHC03+ 1.60 -4.800 FES04+ 0.00 0.000 C03- 0.00 -10.084 HGHC03+ 0.00 -7.879 AL+++ 0.00 0.000 H2S 11.21 -3.483 CAOH+ 0.02 -6.397 ALOH++ 0.00 0.000 HS- 0.11 -5.744 HGOH+ 0.01 -6.760 AL(0H)2+ 0.00 0.000 0.000 H2S04 0.00 -10.469 NH4+ 0.00 0.000 AL(0H)4- 0.00 0.000 HS04- 14.85 -3.811 FE++ 0.00 0.000 AL(S04)2- 0.00 0.000 B04 14.85 -3.811 FE++ 0.00 0.000 AL(S04)2- 0.00 0.000 HF 0.00 0.000 FE(0H)2 0.00 0.000 ALF3+ 0.00 0.000 NA+ 2137.61 -1.032 FE(0H)3- 0.00 0.000 ALF3 0.00 0.000 NA+ 2137.61 -1.032 FE(0H)2- 0.00 0.000 ALF3 0.00 0.000 NA+ 2137.61 -1.032 FE(0H)2+ 0.00 0.000 ALF3- 0.00 0.000 CA++ 85.18 -2.673 FE(0H)2+ 0.00 0.000 ALF3- 0.00 0.000 CA++ 85.18 -2.673 FE(0H)2+ 0.00 0.000 ALF3- 0.00 0.000 ALF3- 0.00 0.000 CA++ 85.18 -2.673 FE(0H)2+ 0.00 0.000 ALF3- 0.00 0.000 ALF3- 0.00 0.000 CA++ 85.18 -2.673 FE(0H)2+ 0.00 0.000 ALF3- 0.00 0.000 ALF3- 0.00 0.000 ALF3- 0.00 0.000 ALF3- 0.00 0.000 ALF3- 0.00 0.000 CA++ 85.18 -2.673 FE(0H)2+ 0.00 0.000 ALF3- 0.00 0.000 ALF3-	H2C03	234.63	-2,422	MGC03	0.00	-11,119	FES04	0.00	0.000
C03 0.00 -10.084 HBHC03+ 0.00 -7.879 AL+++ 0.00 0.000 H2S 11.21 -3.483 CA0H+ 0.02 -6.337 ALOH++ 0.00 0.000 MS- 0.11 -5.494 HSOH+ 0.01 -6.760 ALOH++ 0.00 0.000 S 0.00 -14.534 HH4H 0.00 0.000 ALOH+4 0.00 0.000 D.000 H2E04 0.00 -10.469 NH44 0.00 0.000 ALOH)3 0.00 0.000 H2E04 0.00 -10.469 NH44 0.00 0.000 ALOH)4 0.00 0.000 H2E04 0.00 -10.837 FE1+4 0.00 0.000 ALOH)4 0.00 0.000 D.000 D.000 D.000 ALS0122 D.00 0.000 ALS0122 D.00 D.000 ALS0122 D.00 D.000 ALS0122 D.00 D.000 ALS0122 D.00 D.000 ALS0142 <t< td=""><td>HC03-</td><td>1.26</td><td>-4.686</td><td>CAHC03+</td><td>1.60</td><td>-4.800</td><td>FESO4+</td><td>0.00</td><td>0.000</td></t<>	HC03-	1.26	-4.686	CAHC03+	1.60	-4.800	FESO4+	0.00	0.000
H2S 11.21 -3.483 CAOH+ 0.02 -6.397 ALDH++ 0.00 0.000 NS- 0.11 -5.494 HSOH+ 0.01 -6.760 ALCH+2 0.00 0.000 S 0.00 -14.534 HH4H 0.00 0.000 ALCH13 0.00 0.000 H2E04 0.00 -10.459 HH4H 0.00 0.000 ALCH13 0.00 0.000 H2E04 4.46 -4.337 FE++ 0.00 0.000 ALCB14 0.00 0.000 B04 14.455 -3.811 FE++ 0.00 0.000 ALCB14 0.00 0.000 FE 0.00 0.000 FE(H+) 0.00 0.000 ALCS172 0.00 0.000 CL- 3672.10 -0.985 FE(OH)2- 0.00 0.000 ALF3 0.00 0.000 CL- 3672.51 FE(OH)2+ 0.00 0.000 ALF5 0.00 0.000 CAH 85.18 -2.673 FE(OH)2+ 0.00 0.000 ALF5 0.00 0.00	C03	0.00	-10.084	HGHC03+	0.00	-7.879	AL+++	0.00	0.000
HS- 0.11 -5.494 HBOH 0.01 -6.760 AL(OH)2+ 0.00 0.000 S 0.00 -14.534 HH40H 0.00 0.000 AL(OH)3 0.00 0.000 H2S04 0.00 -10.469 HH44 0.00 0.000 AL(OH)4- 0.00 0.000 HS04- 4.46 -4.337 FE+H 0.00 0.000 AL(S01)2- 0.00 0.000 SU4 H485 -3.811 FE+H 0.00 0.000 AL(S01)2- 0.00 0.000 SU4 0.00 0.000 AL(S01)2- 0.00 0	H28	11.21	-7.497	CANH4	0.02	-6.397	AL DH++	0.00	0.000
No. OVI1 OVI2 OVI2 <th< td=""><td>VC_</td><td>0.11</td><td>-5.494</td><td>NCUNT</td><td>0.01</td><td>-4.740</td><td>AL (0H) 24</td><td>0.00</td><td>0.000</td></th<>	VC_	0.11	-5.494	NCUNT	0.01	-4.740	AL (0H) 24	0.00	0.000
Difference Differe	Car	0 00	_1A 57A	NUAGU	0.00	0.000	AL / DU Y Z	0.00	0.000
H2504 0.00 -0.00 -0.00 0.00 0.00 0.00 0.00	00004	V+VV A AA	10 0/0	NEV40E	0+00	0.000	HL (OH) J	0.00	0+000
HSU4- HS	H2504	0.00	-10,467	NH4T	0,00	0.000	AL(UH)4-	0.00	0.000
SUA 14.85 -3.811 FEH+ 0.00 0.000 AL(SD4)2- 0.00 0.000 HF 0.000 0.000 FECHH 0.00 0.000 ALF3 0.00 0.000 CL- 3672.10 -0.985 FE(OH)3- 0.00 0.000 ALF3 0.00 0.000 NA+ 2137.61 -1.032 FE(OH)4 0.00 0.000 ALF3 0.00 0.000 NA+ 2137.61 -1.032 FE(OH)4+ 0.00 0.000 ALF5 0.00 0.000 CA+ 437.52 -1.951 FE(OH)2+ 0.00 0.000 ALF5 0.00 0.000 CA++ 85.18 -2.673 FE(OH)2+ 0.00 0.000 ALF5 0.00 0.000 IONIC STRENGTH = 0.10851 IONIC BALANCE : CATIONS (HOL.E0.)0.10848394 ANIONS (HOL.E0.)0.10392465 DIFFERENCE (2) 4.29 CHEMICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 BUARTZ 259.9 CHALCEDOWY 979.9 NAK 2B3.1 OXIDATION POTENTIAL (VOLTS) : EH H2S = -0.403 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, TEOR, CALC, ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.979 ANALCIME -11.542 97.979 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 NG-CHLORITE -95.609 99.999 FLUGRITE -11.006 99.979 MAGNETITE -11.542 97.979 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 NG-CHLORITE -95.609 99.999 FLUGRITE -11.006 99.999 MAGNETITE -16.058 99.979 LAUMONTITE -24.635 99.999 K-MONTMOR, -33.916 99.999 MAGNETITE -16.058 99.979 PARMORT -23.84 99.999 K-MONTMOR, -33.916 99.999 PRENTITE -37.627 97.979 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 PRENTITE -37.627 97.979 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 RENTE -37.627 -2.063	H504-	4+46	-4:33/	+E++	0.00	0.000	ALSU4+	0.00	0.000
HF 0.00 0.000 FE0H+ 0.00 0.000 ALF++ 0.00 0.000 F- 0.00 0.000 FE(0H)2 0.00 0.000 ALF2+ 0.00 0.000 CL- 3672.10 -0.985 FE(0H)3- 0.00 0.000 ALF3 0.00 0.000 NA+ 2137.61 -1.032 FE(0H)4-+ 0.00 0.000 ALF4- 0.00 0.000 K+ 437.52 -1.951 FE(0H)4+ 0.00 0.000 ALF5 0.00 0.000 CA++ 85.18 -2.673 FE(0H)2+ 0.00 0.000 ALF5 0.00 0.000 IOHIC STRENGTH = 0.10851 IONIC BALANCE : CATIONS (HOL.EQ.)0.1084839A ANIONS (HOL.EQ.)0.10392465 DIFFERENCE (%) 4.29 CHEMICAL GEOTHERHOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 BUARTZ 259.9 CHALCEDONY 999.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H2S -0.403 EH CH4= 99.999 EH H2= 99.999 EH MH3= 99.999 LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER TEOR, CALC, TEOR, CALC, TEOR, CALC, TEOR, CALC, ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.663 MG-CHLORITE -85.609 99.999 ALBITE LOW -13.941 99.999 GOETHITE 2.776 99.9999 LAUMONTIFE -24.635 99.999 MICROLINE -15.028 99.999 MAGNETITE -16.058 99.9999 CA-HONTMOR, -72.386 99.999 MICROLINE -33.916 99.999 PREMITE -16.058 99.9999 PYRRHOTITE -15.934 99.999 MISCOVITE -17.838 99.999 PREMITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.067 -2.063	S04	14.85	-3,811	FE+++	0.00	0.000	AL(\$04)2	- 0.00	0.000
F- 0.00 0.000 FE(OH)2 0.00 0.000 ALF24 0.00 0.000 CL- 3672.10 -0.995 FE(OH)3- 0.00 0.000 ALF3 0.00 0.000 NA+ 2137.61 -1.032 FE(OH)4 0.00 0.000 ALF3- 0.00 0.000 K+ 437.82 -1.951 FE(OH)4- 0.00 0.000 ALF6 0.00 0.000 CA++ 85.18 -2.673 FE(OH)2+ 0.00 0.000 ALF6 0.00 0.000 IONIC STRENGTH = 0.10851 IONIC BALANCE : CATIONS (MOL.EQ.)0.10348374 ANIONS (MOL.EQ.)0.10392465 DIFFERENCE (Z) 4.29 CHEMICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 RUARTZ 259.9 EH H25 = -0.403 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 -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANYDRITE <td< td=""><td>HF</td><td>0.00</td><td>0.000</td><td>FEOH+</td><td>0.00</td><td>0.000</td><td>ALF++</td><td>0.00</td><td>0.000</td></td<>	HF	0.00	0.000	FEOH+	0.00	0.000	ALF++	0.00	0.000
CL- 3672.10 -0.985 FE(DH)3- 0.00 0.000 ALF3 0.00 0.000 NA+ 2137.61 -1.032 FE(DH)4 0.00 0.000 ALF4- 0.00 0.000 CA++ 437.52 -1.951 FE(DH)++ 0.00 0.000 ALF5 0.00 0.000 CA++ 85.18 -2.673 FE(DH)2+ 0.00 0.000 ALF6 0.00 0.000 IONIC STRENGTH = 0.10851 IONIC BALANCE : CATIONS (HOL.EQ.)0.10848394 ANIONS (HOL.EQ.)0.10392465 DIFFERENCE (%) 4.29 CHEMICAL GEOTHERHOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 BUARTZ 259.9 CHALCEDONY 999.9 NAK 283.1 OXIDATION POTENTIAL (VDLTS) : EH H2S= -0.403 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999 LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP MATER TEOR, CALC, TEOR, CALC, TEOR, CALC, TEOR, CALC, ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.999 AMALCINE -11.542 99.999 ANFYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 ALBITE LOW -13.941 99.999 MAGNETITE -16.058 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -11.006 99.999 MGENDHITE 2.776 99.999 NACK 7.2836 99.999 NICROCLINE -15.028 99.999 MGENDHITE -16.058 99.999 NA-MONTMOR, -34.197 99.999 K-MONTMOR, -33.916 99.999 MGENDHITE -16.058 99.999 NA-MONTMOR, -34.197 99.999 NUSCOVITE -17.838 99.999 PREHNITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.067 -2.063	F-	0.00	0.000	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
NA+ 2137.61 -1.032 FE(DH)4 0.00 0.000 ALF4 0.00 0.000 K+ 437.52 -1.951 FE(DH)4+ 0.00 0.000 ALF5 0.00 0.000 CA++ 85.18 -2.673 FE(DH)2+ 0.00 0.000 ALF6 0.00 0.000 IDNIC STRENGTH = 0.10851 IONIC BALANCE : CATIONS (HOL.E0.)0.10848394 ANIONS (MOL.E0.)0.10392465 DIFFERENCE (%) 4.29 CHEMICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 BUARTZ 259.7 CHALCEDONY 999.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H25= -0.403 EH CH4= 99.999 EH H2= 99.999 EH NH3= 99.999 LOG SOLUBILITY PRODUCTS OF NINERALS IN DEEP MATER TEOR. CALC. TEOR. CALC. ADULARIA -14.381 99.999 ALBITE LOW -13.741 99.999 AMALCIME -11.542 99.999 ANIVERITE -82.635 99.999 ALGITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -82.635 99.999	CL-	3672.10	-0.985	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
K+ 437.52 -1.951 FE(0H)++ 0.00 0.000 ALF5 0.00 0.000 CA++ 85.18 -2.673 FE(0H)2+ 0.00 0.000 ALF6 0.00 0.000 IONIC STRENGTH = 0.10851 IONIC BALANCE : CATIONS (HOL.E0.)0.10848394 ANIONS (HOL.E0.)0.10392465 DIFFERENCE (%) 4.29 CHEMICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 GUARTZ 259.7 CHALCEDONY 979.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H25= -0.403 EH CH4= 97.999 EH H2= 97.999 EH NH3= 97.999 LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER TEOR, CALC. TEOR, CALC. TEOR, CALC. ANALCEME -11.542 97.999 ANULARIA -14.331 97.997 ALBITE LOW -13.941 97.999 ANALCEME -11.542 97.999 ANULARIA -14.331 97.997 ALBITE LOW -13.941 97.999 ANALCEME -11.542 97.999 AULARIA -14.353 97.997 FLUORITE -13.005 -14.367 CHALCEDONY </td <td>NAt</td> <td>2137.61</td> <td>-1.032</td> <td>FE(OH) 4</td> <td>0.00</td> <td>0.000</td> <td>ALF4-</td> <td>0.00</td> <td>0.000</td>	NAt	2137.61	-1.032	FE(OH) 4	0.00	0.000	ALF4-	0.00	0.000
CA++ 85.18 -2.673 FE(DH)2+ 0.00 0.00 ALF6 0.00 0.000 IDNIC STRENGTH = 0.10851 IDNIC BALANCE : CATIONS (MOL.E0.)0.10848394 ANIONS (MOL.E0.)0.10392465 DIFFERENCE (%) 4.29 CHEMICAL GEOTHERHOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 BUARTZ 259.9 CHALCEDONY 999.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.403 EH CH4= 99.999 EH NH3= 99.999 LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER MG-CALC. TEOR. CALC. TEOR. CALC. TEOR. CALC. ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -82.73 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -19.59 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -13.005 -14.367 CHALCEDONY -11.542 99.9999 LAIMONTITE -24.635 97.999 MICROCLINE -15.028 99.999 MAGNETITE -16.058 99.9999 CA-MONTMOR. -72.836 99.999 PREMNITE	K+	437.52	-1.951	FE(0H)++	0.00	0.000	ALF5	0.00	0.000
IONIC STRENGTH = 0.10851 IONIC BALANCE : CATIONS (HOL.E0.)0.10848394 ANIONS (HOL.E0.)0.10392465 DIFFERENCE (%) 4.29 CHEMICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 BUARTZ 259.9 CHALCEDONY 979.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H25= -0.403 EH CH4= 99.979 EH H2= 97.979 EH NH3= 97.979 LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER TEOR. CALC. TEOR. CALC. TEOR. CALC. TEOR. CALC. ADULARIA -14.381 99.979 ALBITE LOW -13.941 99.979 ANALCIME -11.542 99.979 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.979 FLUORITE -11.006 97.979 GOETHITE 2.776 97.979 LAUNONTIE -24.435 97.979 MICROCLINE -15.028 97.979 MAGNETITE -16.058 99.979 NA-MONTINGR72.586 97.979 K-MONTHOR33.916 97.979 PREHNITE -74.070 97.979 NA-MONTMOR, -34.177 97.979 MUSCOVITE -17.838 97.979 PREHNITE -37.629 97.979 PYRRHOTITE -15.934 99.979 PYRITE -34.878 97.979 QUARTZ -2.067 -2.063	CA++	85.18	-2.673	FE(0H)2+	0.00	0.000	ALF6	0.00	0.000
IONIC STRENGTH = 0.10851 IONIC BALANCE : CATIONS (HOL.EQ.)0.10848394 AMIONS (HOL.EQ.)0.10392465 DIFFERENCE (%) 4.29 CHEMICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 BUARTZ 259.9 CHALCEDONY 999.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.403 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. TEOR, CALC. ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 99.999 GOETHITE 2.776 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 99.999 MAGNETITE -16.058 99.999 CA-MONTMOR, -72.386 99.999 K-MONTMOR, -33.916 99.999 MG-MONTMOR, -74.090 99.999 NA-MONTMOR, -34.197 99.999 MUSCOVITE -17.838 99.999 PREHNITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.067 -2.063		0.000					10 17 1 17 1		
ANIONS (MOL.ED.)0.10392465 DIFFERENCE (%) 4.29 CHENICAL GEOTHERHOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 BUARTZ 259.9 CHALCEDONY 999.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.403 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, TEOR, CALC, ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEBONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 99.999 GOETHITE 2.776 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 99.999 MAGNETITE -16.058 99.999 CA-MONTMOR, -72.586 99.999 K-MONTMOR, -33.916 99.999 NG-MONTMOR, -74.090 99.999 NA-MONTMOR, -34.197 99.999 MUSCOVITE -17.838 99.999 PREHNITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.067 -2.063	IONIC STRE	NGTH = 0	.10851 IONI	C BALANCE :	CATIONS	(MOL,EQ.)	0.10848394		
DIFFERENCE (%) 4.29 CHEMICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 BUARTZ 259.9 CHALCEDONY 999.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) ; EH H25= -0.403 EH CH4= 99.999 EH H2= 99.999 EH NH3= 97.999 LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER TEOR. CALC. TEOR. CALC. ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCINE -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 99.999 GOETHITE 2.776 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 99.999 MGHNTMOR. -74.090 99.999 CHAMOTIMOR. -72.586 99.999 K=MONTMOR. -33.916 99.999 PRENNITE -37.629 99.999 NA-MONTIMOR. -34.989 99.999 PRENNITE -37.629 99.999					ANIONS	(MOL,EQ.)	0.10392465		
CHEMICAL GEOTHERNOMETERS DEGREES C 1000/T DEGREES KELVIN = 1.88 BUARTZ 259.9 CHALCEDONY 979.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H25= -0.403 EH CH4= 79.979 EH H2= 79.979 EH NH3= 79.979 LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER TEOR. CALC. TEOR. CALC. TEOR. CALC. TEOR. CALC. ADULARIA -14.381 99.999 ALBITE LON -13.941 99.999 ANALCINE -11.542 79.9797 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 79.999 GOETHITE 2.776 79.9797 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 79.999 MAGNETITE -16.058 79.999 AM-MONTMOR. -72.386 99.999 K-MONTMOR. -33.916 99.999 PREHNITE -37.629 79.999 NA-MONTMOR. -34.197 99.999 PYRITE -34.898 99.999 PUARTZ -2.067 -2.063					DIFFERE	ENCE (%)	4.29		
BUARTZ 259.9 CHALCEDONY 999.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.403 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 -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 HICROCLINE -15.028 99.999 MAGNETITE -16.058 99.999 LAUMONTITE -24.635 99.999 K-MONTMOR. -33.916 99.999 MG-MONTMOR. -74.090 99.999 NA-MONTMOR. -34.197 99.999 PYRITE -17.838 99.999 PREHNITE -37.629 99.999 PYRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.067 -2.063	CHENTCAL G	COTUEDNOM	TEDE NERDEER P		1000/T	NEGREES KE	1078 = 1.99		
BUARTZ 259.9 259.9 CHALCEDONY 999.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H25= -0.403 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 -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 97.979 FLUORITE -11.006 99.979 GOETHITE 2.776 97.979 LAUMONTITE -24.635 97.979 MICROCLINE -15.028 97.979 MAGNETITE -16.058 97.979 NA-MONTMOR. -72.386 97.979 K-MONTMOR. -33.916 97.979 MG-MONTMOR. -74.090 97.979 NA-MONTMOR. -34.197 97.979 PYRITE -34.878 97.979 PREHNITE -37.629 97.979 PYRRHOTITE -15.934 97.979 PYRITE -34.878	WINETTE WINE W	597116041601	LIENO DEGNELO O		100007	Dis Officia Officia	2020 - 2000		
CHALCEBONY 999.9 NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.403 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 -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 99.999 GOETHITE 2.776 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 79.999 MGACHITE -16.058 79.999 CA-MONTMOR. -72.386 99.999 K-MONTMOR. -33.916 99.9999 MG-MONTMOR. -74.090 99.999 NA-MONTMOR. -34.197 99.999 PYRITE -34.898 99.999 PREHNITE -37.629 99.999	QUARTZ	259.9							
NAK 283.1 OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.403 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 -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 99.999 GOETHITE 2.776 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 99.999 MG-MONTMOR. -74.090 99.999 NA-MONTMOR. -72.586 99.999 K-MONTMOR. -33.916 99.9999 PREHNITE -37.629 99.999 NA-MONTMOR. -34.197 99.999 PYRITE -34.898 99.999 PREHNITE -37.629 99.999	CHALCEBONY	999.9							
NHK 20071 OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.403 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 -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 99.999 GOETHITE 2.776 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 99.999 MAGNETITE -16.058 99.999 CA-MONTMOR. -72.586 99.999 K-MONTMOR. -33.916 99.999 PREHNITE -37.629 99.999 NA-MONTMOR. -34.197 99.999 PYRITE -34.898 99.999 PREHNITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.067 -2.063	NAK	287.1							
OXIDATION POTENTIAL (VOLTS) : EH H2S= -0.403 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. TEOR. CALC. ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 MICROCLINE -15.028 99.999 GOETHITE -16.058 99.999 LAUMONTITE -24.635 99.999 K-MONTMOR. -33.916 99.999 MG-MONTMOR. -74.090 99.999 NA-MONIMOR. -34.197 99.999 MUSCOVITE -17.838 99.999 PREHNITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 RUARTZ -2.067 -2.063	MAR	200+1							
LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER TEOR, CALC, TEOR, CALC, TEOR, CALC, TEOR, CALC, ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 99.999 GOETHITE 2.776 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 99.999 MAGNETITE -16.058 99.999 CA-MONTMOR, -72.586 99.999 K-MONTMOR, -33.916 99.999 MG-MONTMOR, -74.090 99.999 NA-MONTMOR, -34.197 99.999 MUSCOVITE -17.838 99.999 PREHNITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.067 -2.063	OXIDATION	POTENTIAL	(VOLTS) :	EH H2S= -0,40	3 EH	CH4= 99,99	9 EH H2= 99	999 EH NH	3= 99,999
LOG SOLUBILITY PRODUCTS OF MINERALS IN DEEP WATER TEOR, CALC. TEOR, CALC. ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 99.999 GOETHITE 2.776 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 99.999 MAGNETITE -16.058 99.999 CA-MONTMOR. -72.586 99.999 K-MONTMOR. -33.916 99.9999 MG-MONTMOR. -74.090 99.9999 NA-MONIMOR. -34.197 99.999 MUSCOVITE -17.838 99.999 PREHNITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.063									
TEOR, CALC, TEOR, CALC, TEOR, CALC, ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCINE -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 99.999 GOETHITE 2.776 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 99.999 MAGNETITE -16.058 99.999 CA-MONTMOR. -72.586 99.999 K-MONTMOR. -33.916 99.9999 MG-MONTMOR. -74.090 99.9999 NA-MONTMOR. -34.197 99.999 MUSCOVITE -17.838 99.999 PREHNITE -37.629 99.9999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.063	LOG SOLUBI	LITY PROD	UCTS OF MINERALS	IN DEEP WATE	R			7500	CALC
ADULARIA -14.381 99.999 ALBITE LOW -13.941 99.999 ANALCIME -11.542 99.999 ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEDONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 99.999 GOETHITE 2.776 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 99.999 MAGNETITE -16.058 99.999 CA-MONTMOR. -72.586 99.999 K-MONTMOR. -33.916 99.999 MG-MONTMOR. -74.090 99.999 NA-MONTMOR. -34.197 99.999 MUSCOVITE -17.838 99.999 PREHNITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.063	10 Mar 20 Mar	TEO	K, CALC.		IEUR	. CALC.		IEUK.	UALU+
ANHYDRITE -8.273 -8.129 CALCITE -13.005 -14.367 CHALCEBONY -1.959 -2.063 MG-CHLORITE -85.609 99.999 FLUORITE -11.006 99.999 GOETHITE 2.776 99.999 LAUMONTITE -24.635 99.999 MICROCLINE -15.028 99.999 MAGNETITE -16.058 99.999 CA-MONTMOR. -72.586 99.999 K-MONTMOR. -33.916 99.999 MG-MONTMOR. -74.090 99.999 NA-MONTMOR. -34.197 99.999 MUSCOVITE -17.838 99.999 PREHNITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.067 -2.063	ADULARIA	-14.3	81 99+999	ALBITE LOW	-13,9/	11 99,999	ANALCIME	-11.542	44.444
MG-CHLORITE -85,609 99,999 FLUORITE -11,006 99,999 GOETHITE 2.776 99,999 LAUMONTITE -24,635 99,999 MICROCLINE -15,028 99,999 MAGNETITE -16,058 99,999 CA-MONTMOR. -72,586 99,999 K-MONTMOR. -33,916 99,999 MG-MONTMOR. -74,090 99,999 NA-MONTMOR. -34,197 99,999 MUSCOVITE -17,838 99,999 PREHNITE -37,629 99,999 PYRRHOTITE -15,934 99,999 PYRITE -34,898 99,999 QUARTZ -2,067 -2,063	ANHYDRITE	-8+2	73 -8.129	CALCITE	-13.00)5 -14.367	CHALCEDO	×r -1.959	-2.063
LAUMONTITE -24.635 99.999 MICROCLINE -15.028 99.999 MAGNETITE -16.058 99.999 CA-MONTMOR. -72.586 99.999 K-MONTMOR. -33.916 99.999 MG-MONTMOR. -74.090 99.999 NA-MONTMOR. -34.197 99.999 MUSCOVITE -17.838 99.999 PREHNITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.067 -2.063	MG-CHLORIT	E -85+6	09 99.999	FLUORITE	-11.0()6 99,999	GOETHITE	2.776	99,999
CA-MONTMOR. -72.586 99.999 K-MONTMOR. -33.916 99.999 MG-MONTMOR. -74.090 99.999 NA-MONTMOR. -34.197 99.999 MUSCOVITE -17.838 99.999 PREHNITE -37.629 99.999 PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.067 -2.063	LAUMONTITE	-24.6	35 99.999	MICROCLINE	-15.02	8 99,999	MAGNETIT	E -16.058	99,999
NA-MONTMOR, -34,197 99,999 MUSCOVITE -17,838 99,999 PREHNITE -37,629 99,999 PYRRHOTITE -15,934 99,999 PYRITE -34,898 99,999 QUARTZ -2,067 -2,063	CA-MONTMOR	72.5	86 99,999	K-MONTMOR .	-33,91	6 99,999	MG-MONTH	OR74.090	99,999
PYRRHOTITE -15.934 99.999 PYRITE -34.898 99.999 QUARTZ -2.067 -2.063	NA-MONTMOR	34.1	97 99,999	MUSCOVITE	-17,83	8 99,999	PREHNITE	-37+629	99,999
	PYRRHOTITE	-15.9	34 99.999	PYRITE	-34.89	99.999	QUARTZ	-2.067	-2,063
WAIRAKITE -24,723 99,999 WOLLASTONITE 7,335 5,046 ZOISITE -38,365 99,999	WAIRAKITE	24.7	23 99,999	WOLLASTONITE	7.33	5 5.046	ZOISITE	-38,365	99,999
EPIDOTE -37.900 99.999 MARCASITE -18.420 99.999	EPIDOTE	-37,9	00 99.999	MARCASITE	-18.42	99.999			

GEOCHEMISTRY OF WELL OKOY-12D ORKUSTOFNUN JHD 1982-11-12 OLIVER XXXXXXXXXXXX810912XXXX OKOY-12D S.NEGROS, PHILIPPINES PUHAGAN PROGRAM WATCH1. WATER SAMPLE (PPM) STEAM SAMPLE REFERENCE TEMP. DEGREES C 250.0 (MEASURED) PH/DEG.C 6,70/25,0 GAS (VDL.%) 0.00 SI02 532,00 C02 2352.00 H2S 0.00 SAMPLING PRESSURE BARS ABS. 11.0 NA DISCHARGE ENTHALPY MJOUL/KG 1.089 (MEASURED) H2 457.00 0.00 K 76.00 02 0.360 CH4 43.00 N2 0.00 DISCHARGE KG/SEC. 16.8 CA MG 0.00 0.00 MEASURED TEMPERATURE DEGREES C 0.0 C02 RESISTIVITY/TEMP. OHMM/DEG.C 0.0/ 0.0 S04 32.00 NV/DEG.C 0.000/ 0.0 H2S 82.60 EH/TEMP . CL 4361.00 0.00 LITERS GAS PER KG CONDENSATE/DEG.C 16.90/25.0 MEASURED DOWNHOLE TEMP. FLUID INFLOW F DISS.SOLIDS 0.00 AL DEGREES C/METERS 0.0000 DEPTH (METERS) B 49.2000 FE CONDENSATE (PPM) 0.0 0.0 0.0000 0.0 PH/BEG.C 0.00/ 0.0 0.0 0.0 NH3 0.0000 0.0 0.0 0.0 0.0 C02 0.00 H2S 0.00 0.0 0.0 0.0 0.0 0.0 NA 0.00 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 0.0 0.0 0.0 C02 31728.90 0.0 H2S 435.30 0.0 IONIC STRENGTH = 0.12351 IONIC BALANCE : CATIONS (MOL.EQ.)0.11755587 ANIONS (MOL.EQ.)0.12505311 BIFFERENCE (%) -6.18 GAS PRESSURES (BARS ABS.) DEEP STEAM (PPM) DEEP WATER (PPM) C02 C02 532191.44 C02 451.20 3441+02 0.866E+01 \$102 H2S 0.121E+00 H2S 5742.93 H2S NA 1994.63 121.17 H2 0.000E+00 H2 0.00 ĸ 387.54 H2 0.00 02 0.00 02 0.00 02 0.000E+00 CA 64.45 0.305 CH4 CH4 CH4 0.00 0.00 0.000E+00 MG 27+14 N2 N2 0.00 N2 0.00 0.000E+00 S04 3698.06 NH3 CL. 0.00 NH3 0.00 NH3 0.000E+00 H20 0.398E+02 5 0.00 DISS.S. TOTAL 0.486E+02 0.00 AL 0.0000 41,7204 H20 (%) 0,28 B FE BOILING PORTION 0.15 0.0000

	*********					***********		**********	
A07711771	COFFEEDATES		114755						
ACTIVITY	CUEFFICIER	IS IN DEEP	WAIER	-		0 107	FEAL 1	5 /47	
HT	0+707	12	U4- V+648	F	277	0:173	FEULT	0+61/	
UH-	0.605	F-	0,605	F	Lttt	0+047	ALttt	0.047	
H35104-	0.61/	CL	- 0+592	F	EUHt	0.639	ALOH++	0+180	
H2S104	0,180	NA	+ 0.617	F	E(OH)3-	0.639	AL(0H)2+	0.648	
H2B03-	0.578	K4	0.592	FI	E(OH)4	0.171	AL(0H)4-	0.629	
HCO3-	0+617	CA	H 0.193	F	EOH++	0.171	ALS04+	0.629	
C03	0.160	MG	+ 0.236	FI	E(OH)2+	0.648	AL(S04)2-	0.629	
HS-	0.605	CA	10031 0+659	FI	E(OH)4-	0+648	ALF++	0,180	
S	0.171	MGI	IC03+ 0.617	FI	ESD4+	0.639	ALF2+	0.648	
HS04-	0.629	CA	0+659 Other	FI	ECL++	0,171	ALF4-	0,629	
504	0.149	MG	0.668	FI	ECL2+	0.639	ALF5	0.160	
NAS04-	0.648	NH	4+ 0.578	FI	ECL4-	0,617	ALF6	0.016	
				710				10.000	
CHEMICAL	COMPONENTS	IN DEEP W	ATER (PPM AND LOG	MOLE)					
Ht (ACT.)	0.00	-5.523	MG++	0.28	-4.943	FE(OH)3	0.00	0.000	
OH-	0.08	-5.310	NACL	281.43	-2.317	FE(OH)4	- 0.00	0.000	
HASTOA	721.23	-2,125	KCL	26.61	-3.447	FECL+	0.00	0.000	
HISTOA-	D.72	-5.449	NACOA-	6.09	-1.202	FEPI 2	0.00	0.000	
N33104	0 00	-10 050	KCOA.	5 45	-4 701	FEGLZ	0.00	0.000	
NAU70104	0.07	-10.000	CACOA	3+02	-9+301	FEULTT	0.00	0.000	
117007	010 50	-3+/1/	CH504	4+4/	-4+483	FEULZT	0.00	0.000	
H3BU3	238+32	-2,414	76504	0.09	-6+118	FECL3	0.00	0.000	
H2BU3-	0.11	-5+744	CACU3	0.06	-6+256	FECL4-	0.00	0.000	
H2C03	4769+28	-1.114	MGC03	0.00	-9,493	FES04	0.00	0.000	
HC03-	56,15	-3.036	CAHC03+	38+37	-3,421	FES04+	0.00	0.000	
C03	0.00	-8,122	MGHC03+	0,02	-6.558	AL+++	0.00	0.000	
H2S	118.64	-2,458	CAOH+	0.02	-6.446	ALOH++	0.00	0.000	
HS-	2.45	-4.130	MGOH+	0.00	-6.950	AL(OH)2	+ 0.00	0.000	
5	0.00	-13,002	NH40H	0.00	0.000	AL(DH)3	0,00	0.000	
H2S04	0.00	-11+162	NH4+	0.00	0.000	AL(OH)4	- 0.00	0.000	
HS04-	1.77	-4.738	FE++	0.00	0.000	ALS04+	0.00	0.000	
S04	13.26	-3.860	FE+++	0.00	0.000	AL(S04)	2- 0.00	0.000	
HF	0.00	0.000	FEOH	0.00	0.000	ALF++	0.00	0.000	
F-	0.00	0.000	FE(OH)2	0.00	0.000	AL F2+	0.00	0.000	
C1 -	3514.49	-1.004	FE(0H)3-	0.00	0.000	ALE3	0.00	0.000	
NAL	1002.40	-1.097	FE(0H) A	0.00	0.000	AL FA-	0.00	0.000	
KT.	771 04	-2 022	EE (OU) 11	0.00	0.000	AL ES	0.00	0.000	
CALL	0/1+70 A7 00	-2:022	FELODITT	0.00	0.000	ALC/	0.00	0.000	
LATT	4/+87	-2+723	FE(UH)2T	0.00	0.000	ALLO	0+00	0.000	
10010 010	NOTIL - A	000//	TONTO DALANOT	CATTOM	(101 50 1	A AD41077A			
TOMIC SING	- non - v	V7000	IUNIC DHLARGE +	CRITONS	(NOL FO)	V+V7417//V			
				ANIUNS	(RUL, EU,)	0+10042552			
				DIFFERE	INCE (%)	-6+40			
					DEADERA VE				
CHEMICAL	GEOTHERMOM	ETERS DEGRE	ES C	1000/T	DEGREES KE	LVIN = 1.91			
1000 (1000) - 1000 (1000)									
QUARTZ	243.3								
CHALCEDON	(9 99 ,9								
NAK	278.7								
							1.0725 GTT		
OXIDATION	POTENTIAL	(VOLTS) :	EH H2S= -0.4	39 EH	CH4= 99+99	9 EH H2= 9	9.999 EH	NH3= 99.999	
LOG SOLUBI	LITY PRODU	UCTS OF MIN	ERALS IN DEEP WAT	ER					
	TEOP	R. CALC.		TEOR	. CALC.		TEO	R. CALC.	
ADULARIA	-14,40	99.995	ALBITE LOW	-13.95	6 99.999	ANALCIM	E -11.5	28 99.999	
ANHYDRITE	-8.10	6 -8.325	CALCITE	-12.77	1 -12.555	CHALCED	ONY -1.9	95 -2,125	
HG-CHI ODTI	F -94.90	84 99.000	FLUOPTTE	-10.95	7 90.000	GOFTHIT	F 2.2	73 99,990	
I AUMONTATE	-04+00	77 00 000	ATCOOCT THE	15 07	7 00 000	MACHETT	TE _14 0	10 00 000	
LHORDWIIIC	-24+3/	14 77+777	AICKOLLINE	-13:07	J 77+777	HHORE I I	KOD	00 00 000	
LA-MUNIMUR	(+ -/2+6)	0 99+999	K-HUN HHUK	-33+7/	3 77+779	no-nun II	nok+ -/4+0	70 77+777	
NA-MONTMOR	(+ -34+25	02 99,999	NUSCUVITE	-1/,84	3 77,999	FREHRIN	-3/+3	44 77+979	
PYRRHOTITE	-21+0	50 99,999	PTRITE	-41+35	99,999	QUARTZ	-2+1	V3 -2+125	
WAIRAKITE	-24+54	99.999	WOLLASTONIT	E 7,48	14 3+285	201511E	-3/,9	34 44,444	
EPIBOTE	-37.4	72 99,999	MARCASITE	-24,58	56 99+999				

ORKUSTOFNUN JHD GEOCHEMISTRY OF WELL NJ-1D 1982-11-12 OLIVER S.NEGROS, PHILIPPINES NASUJI PROGRAM WATCH3. TEMPERATURE FIXING STEAM LOSS 100.0 DEGREES C WATER SAMPLE (PPM) STEAM SAMPLE PH/DEG.C 5.20/25.0 GAS (VOL.%) REFERENCE TEMP. DEGREES C 243.0 (ARBITRARY) SI02 600.00 C02 NA 1930.00 H2S SAMPLING PRESSURE BARS ABS. K 393.00 H2 DISCHARGE ENTHALPY MJOUL/KG CA 02 16.80 DISCHARGE KG/SEC. 0.0 MG 5.250 CH4 C02 2.54 N2 MEASURED TEMPERATURE DEGREES C 0.0 S04 155.00 RESISTIVITY/TEMP, OHMM/DEG.C 0.0/ 0.0 H2S MV/DEG.C 0.000/ 0.0 2.39 EH/TEMP+ CL 3489.00 F LITERS GAS PER KG 0.00 MEASURED DOWNHOLE TEMP. DISS.SOLIDS 0.00 CONDENSATE/DEG.C FLUID INFLOW DEGREES C/METERS DEPTH (METERS) AL 0.0000 46.9000 B 0.0 0.0 0.0 FE 0.0000 CONDENSATE (PPM) NH3 0.0000 PH/DEG.C 0.0 0.0 0.0 C02 0.0 0.0 0.0 H2S 0.0 0.0 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 0.0 CONDENSATE WITH NAOH (PPM) 0.0 0.0 0.0 C02 0.0 0.0 0.0 H2S 0.0 0.0 0.0 IONIC STRENGTH = 0.10023 IONIC BALANCE : CATIONS (MOL.EQ.)0.09498397 ANIONS (MOL.EQ.)0.10125270 DIFFERENCE (%) -6.39 PH LOWER THAN 4.00 GAS PRESSURES (BARS ABS,) DEEP WATER (PPM) DEEP STEAM (PPM) C02 3727,97 C02 0.00 C02 0,987E+01 SI02 431.94 1389.30 H2S 1220,27 H2S 0.00 H2S 0.129E+01 NA 282,88 H2 0.00 H2 0.00 H2 0.000E+00 K 02 02 0.00 02 0.000E+00 CA 12.09 0.00 MG 3.779 CH4 0.00 CH4 0,00 CH4 0.000E+00 N2 0.00 N2 0.000E+00 S04 N2 0.00 111.57 0,00 NH3 0.00 NHJ 0.000E+00 NH3 2511,32 CL H20 0.353E+02 F 0.00 DISS.S. 0,00 TOTAL 0.464E+02 AL 0.0000 H20 (%) 0.00 33.7576 B BOILING PORTION 0.00 FE 0.0000

ACTIVITY	COEFFICIENTS 1	IN DEEP WATER					
Ht	0,736	KS04-	0.686	FE++	0.239	FECL+	0.662
OH-	0.652	F-	0.652	FE+++	0.066	AL+++	0.066
H3SI04-	0,662	CL-	0.641	FEOH+	0.680	ALOH++	0,226
H2SI04	0,226	NAt	0.662	FE(OH)3-	0.680	AL(0H)2+	0,686
H2B03-	0.630	K+	0.641	FE(0H)4	0.217	AL(0H)4-	0.671
HC03-	0.662	CA++	0.239	FEOH++	0,217	ALSO4+	0.671
C03	0.206	NG++	0.279	FE(0H)2+	0.686	AL(S04)2-	0.671
HS-	0+652	CAHC03+	0.696	FE(OH)4-	0+686	ALF++	0.226
S	0.217	MGHC03+	0.662	FES04+	0.680	ALF2+	0.686
HS04-	0.671	CAOH+	0.696	FECL++	0.217	ALF4-	0.671
S04	0.195	MGOH+	0.703	FECL2+	0.480	ALF5	0.206
NASO4-	0.686	NH4+	0.630	FECL4-	0.662	ALF6	0.029

PH LOWER THAN 4.00

CHE	MICAL	COMP	ONENTS	IN	DEEP	WATER	(PPM	AND	LOG	MOLE)
111	7 APT	1	A A4		000		MO	11		0

H+ (ACT.)	0.01	-4.902	MG++	2+77	-3,944	FE(OH)3	0.00	0.000
OH-	0.02	-5,982	NACL	135,56	-2.635	FE(0H)4-	0.00	0.000
H4SI04	690.82	-2.143	KCL	13.52	-3.741	FECL+	0.00	0,000
H3SI04-	0.08	-6.093	NASO4-	19,41	-3.788	FECL2	0.00	0.000
H2SI04	0.00	-12+110	KS04-	17.70	-3.883	FECL++	0.00	0.000
NAH3SID4	0.04	-6,444	CAS04	4,71	-4.461	FECL2+	0.00	0.000
H3803	193.06	-2.506	MGSO4	4.88	-4.392	FECL3	0.00	0.000
H2B03-	0.02	-6.476	CAC03	0.00	-8.031	FECL4-	0.00	0.000
H2C03	5236.00	-1.074	MGC03	0.00	-9.555	FES04	0.00	0.000
HC03-	16.52	-3.568	CAHC03+	2.52	-4.603	FES04+	0.00	0.000
C03	0.00	-9.280	MGHC03+	0.07	-6.057	AL+++	0.00	0.000
H2S	1213.43	-1,448	CAOH+	0.00	-7,763	ALOH++	0.00	0.000
HS-	6+63	-3,698	MGOH+	0.01	-6.640	AL (OH) 2+	0.00	0.000
S	0.00	-13.300	NH40H	0.00	0.000	AL(0H)3	0.00	0.000
H2S04	0.00	-9.380	NH4+	0,00	0.000	AL(0H)4-	0.00	0.000
HS04-	26,51	-3.564	FE++	0.00	0.000	ALSO4+	0.00	0.000
S04	49.88	-3,285	FE+++	0.00	0.000	AL(S04)2-	0.00	0.000
HF	0.00	0.000	FEOH+	0.00	0.000	ALF++	0.00	0.000
F-	0.00	0.000	FE(OH)2	0.00	0.000	ALF2+	0.00	0.000
CL-	2422.67	-1.165	FE(OH)3-	0.00	0.000	ALF3	0.00	0.000
NAt	1332.21	-1+237	FE(OH) 4	0.00	0.000	ALF4-	0.00	0.000
K+	270.67	-2.160	FE(OH)++	0.00	0.000	ALF5	0.00	0.000
CA++	9.71	-3.616	FE(OH)2+	0.00	0.000	ALF6	0.00	0.000
IONIC STRE	NGTH = 0	.06861	IONIC BALANCE :	CATIONS	(MOL.EQ.)0	06560814		

CHEMICAL GEOTHERMOMETERS DEGREES C

1000/T BEGREES KELVIN = 1.94

ANIONS (MOL.EQ.)0.06985241 DIFFERENCE (%) -6.27

QUARTZ 239.5 CHALCEDONY 999.9 NAK 284+3

OXIDATION PO	TENTIAL (VO	LTS) :	EH H2S= -0.355	EH CH	4= 99,999	EH H2= 99.999	EH NH3:	÷ 99₊999
LOG SOLUBILI	TY PRODUCTS	OF MINERA	LS IN DEEP WATER					
	TEOR.	CALC.		TEOR .	CALC.		TEOR.	CALC.
ADULARIA	-14,428	99,999	ALBITE LOW	-13,975	99.999	ANALCIME	-11.524	99.999
ANHYDRITE	-7,978	-8,233	CALCITE	-12,591	-14.204	CHALCEDONY	-2.023	-2.143
MG-CHLORITE	-84,354	99.999	FLUORITE	-10,920	99.999	GOETHITE	1,889	99.999
LAUMONTITE	-24,536	99,999	MICROCLINE	-15+119	99.999	MAGNETITE	-17,601	99.999
CA-MONTMOR.	-72+623	99.999	K-MONTMOR .	-34.027	99,999	MG-MONTMOR.	-74.117	99.999
NA-MONTMOR .	-34.300	99.999	MUSCOVITE	-17+852	99.999	PREHNITE	-37,100	99.999
PYRRHOTITE	-24,961	99,999	PYRITE	-46.345	99.999	GUARTZ	-2.135	-2.143
WAIRAKITE	-24,425	99.999	WOLLASTONITE	7+602	3.422	ZOISITE	-37.653	99.999
COTOGTC	77 0/0	00 000	MADCACITE	-10 751	00 000			

ORKUSTOFNU 1982-11-12	n jhd Oliver	1	GEOCHEMISTRY OF	WELL PN-13D		af en av an an an in in an an an an an		
u, u, hu hu hu hu hu hu hu hu hu	820127%%% PUHAG	AN-13	D		S.NEGROS, PHIL	IPPINES PU	Hagan	
PROGRAM WAT	TCH1,							
WATER SAMPL	LE (PPM)	ST	EAM SAMPLE					
PH/DEG.C	5.95/25.0	GA	S (VOL.%)		REFERENCE TEMP+	DEGREES	C 268.0 (MEASURED)	
SI02	675.00	CO	2	0.00				
NA	2472.00	H2	S	0.00	SAMPLING PRESSURE	BARS AB	S. 11.5	
K	551.00	H2		0.00	DISCHARGE ENTHALP	Y MJOUL/	KG 1.202 (MEASURED)	
CA	58.30	02		0.00	DISCHARGE	KG/SE	C. 14.i	
MG	0.380	CH.	4	0.00	5. 10 10 10 10 10 10 10 10 10 10 10 10 10			
002	18.30	NO		0.00	MEASURED TEMPERAT	IRE DEGREES	0.0	
604	24.00	13.6		VIVV	DECIGTIUTTY/TEND.	DHMM/DEG	.C 0.0/ 0.0	
109	10.20				CH/TEMP.	MU/DEG	.C 0.000/ 0.0	
H20	10+20				G17 1 G11 0	1147 44-9	10 010007 010	
5	4773+00	1.7	TEDE DAD DED VO					
F DTOD DOL TR	0+00	C0	HERS DES FER NO	17 00/05 0	WEACHDED DOUNU	OLE TEND	FUITD THEI OU	
0155,50L10	5 0,00	60	NUENSHIE/DEG+L	13+00/23+0	DECODEEC C/M	CTEDC	DEDTU (METEDQ)	
AL.	0.0000				DEGREES 6/H	LICNO	DELLU ANELENOY	
5	01+3000	co	NDENGATE (DDM)		0.0	0.0	0.0	
FE.	0+0000	00	ADENDAIE (FFA)	0.00/ 0.0	0.0	0.0	0.0	
CHN	0+0000	P 51	/ UEG+6	0.007 0.0	0.0	0.0	0.0	
		60.	2	0.00	V+V ∧ ∧	V+V	0+0	
		HZ	5	0.00	V+V	0+0	0.0	
		NA		0.00	0.0	0+0	0+0	
					0.0	0+0	0+0	
					0.0	0+0	0.0	
					0.0	0+0	0+0	
		CO	NDENSATE WITH N	AOH (PPM)	0+0	0+0	0+0	
		CO	2 230	81.90	0.0	0.0	0.0	
		H2	8 6	46.30	0.0	0+0	0.0	
IONIC STREA	NGTH = 0₊13136	I	DNIC BALANCE :	CATIONS (M ANIONS (M DIFFERENCE	OL.EQ.)0.12428541 OL.EQ.)0.13502967 (%) -8.29			
DEEP WATER	(PPM)			DEEP	STEAK (PPH)	GAS PRE	SSURES (BARS ABS.)	
\$102	544.67	C02	1704.92	C82	178562.48	C02	0.390E+01	
NA	1994.52	H2S	92.14	H25	2944.96	H2S	0.830E-01	
K	AAA .55	110	0.00	1120	0.00	H2	0.000F+00	
Ωô.	47.04	02	0.00	02	0.00	02	0.000E+00	
WC	0 707	PUA	0.00	CHA	0.00	CHA	0.000E+00	
204	20.00	NO.	0.00	2014	0.00	N2	0.000F+00	
004	20+07	NLIT	0.00	NU7	0.00	MUZ	0.000E400	
UL E	200/+/0	nn5	0+00	NU2	0.00	1000	0.5775100	
1	0.00					TOTAL	0+3332102	
DISS.S.	0+00					TOTAL	V+J/DETVZ	
AL	0.0000			1100	N/ 1	4 70		
ß	49.4550			H2U (A)	1+/J A 40		
FE	0+0000			BOIL	ING FURITUR	V+17		

	*********						*======				ra: contact	************
			-									
ACTIVITY C	UEPFICIEN	IS IN DEL	EP WATER									
Ht	0+692	1	(S04-	0+629	FE	++	0.172		FECL+		0.597	
OH-	0.584	1	F-	0.584	FE	+++	0.038		AL+++		0.038	
H3SI04-	0.597	1	CL-	0.571	FE	:OH+	0.621		ALOH++		0.159	
H2SI04	0.159	1	NAt	0.597	FE	E(OH)3-	0.621		AL(OH)	2+	0+629	
H2B03-	0.556	1	K+	0.571	FE	(OH)4	0.150		AL(OH)	4-	0.609	
HC03-	0.597	đ	CA++	0,172	F	OH++	0.150		ALS04+		0.609	
CD3	0.140	1	MG++	0,213	FE	(OH)2+	0.629		AL(SO4)2-	0.609	
HS-	0.584		CAHC03+	0.642	FE	E(OH)4-	0,629		ALF++		0.159	
S	0.150	1	MGHC03+	0.597	FE	504+	0.621		ALF2+		0.629	
HS04-	0.609		CARH+	0.642	FF	C1 ++	0.150		AL F4-		0.409	
504	0.129	1	MGOHT	0.651	FF	CI 24	0.421		AL 55		0.140	
NAS04-	0.400	1	MIAL	0.554	50	CI A-	0.507		AL FA-	_	0.012	
RUDAA	V+027		11173	V1000	3.4	o la line "I	44011		Tillal V		V*V14	
CHENTCAL CO	MPONENTS	TN DEED	WATER (DOM AND LOG M	01 F)							
the vace to		A 070	WHILE Y	2011 MILE LOO H	A 00	4 017		FC/0017	^	56	A AAA	
HT (ALI)	0.01	-9+7/7		HUTT	V+27	-4,71/	1	FELUM/3	V	+00	0.000	
UH-	0+03	-2+808		NAUL	42/+6/	-2+136	1	-E(UH)4-	0	+00	0.000	
H4SI04	871.11	-2,043		KCL	42+87	-3.240	1	FECL+	0	•00	0.000	
H3SI04-	0.08	-6.049		NAS04-	3.43	-4.541	F	FECL2	0	.00	0.000	
H2SI04	0.00	-12,083		KS04-	4,38	-4+490	F	FECL++	0	.00	0.000	
NAH3SI04	0.06	-6+304		CAS04	2,52	-4,733	F	FECL2+	0	.00	0.000	
H3E03	282.83	-2.340		MGS04	0.05	-6.387	1	FECL3	0	.00	0.000	
H2803~	0.03	-6.247		04003	0.00	-7.807	F	FECI A-	0	.00	0.000	
H0003	2705.75	-1.417		KCCOX	0.00	-11.097		FESOA	0	.00	0.000	
H2603	2070+00	-1+110		00000	7 07	-1 100		LOOAL	0	00	0.000	
ncus-	0+10	-4+0/3		NOUCOTI	0+7/	7 510	1	ALLLI	0	00	A AAA	
LU3	0+00	71000		HUNGUAT	0.00	-/+312	1	HLTTT	V	00+	01000 01000	
M25	91+78	-2+570		CAUNT	0.01	-0+873	1	ALUNTT	0	+00	0.000	
HS-	0.35	-4+980		MGOH+	0.00	-7.191	8	AL(0H)2+	0	•00	0.000	
S	0.00	-14,260		NH40H	0.00	0+000	ŀ	AL(OH)3	0	•00	0.000	
H2S04	0+00	-10.029		NH4+	0.00	0.000	1	\L(OH)4-	0	.00	0.000	
HS04-	5.59	-4,239		FE++	0.00	0.000	F	LS04+	0	.00	0.000	
S04	6.86	-4.146		FE+++	0.00	0.000	6	L(S04)2-	0	.00	0.000	
HE	0.00	0.000		FEOH+	0.00	0.000	6	LE++	0	.00	0.000	
F	0.00	0.000		FF(OH)2	0.00	0.000	6	1 F24	0	.00	0.000	
CI -	7570.94	-0.997		FE(0H) 3-	0.00	0.000	2	NET.	0	.00	0.000	
MAL	1005 20	-1 100		EE(OU)A	0.00	0.000	1	M CA-	0	00	0.000	
RHT	102J+0V	-1+100		FE(00)4	0.00	0.000		1155	0	00	0,000	
K+	420+80	-1+968		FE(UM)TT	0.00	0+000	1		V	-00	0.000	
CA++	44+72	-2,932		FE(UH)2+	0,00	0+000	,	ALP 6	0	+00	0+000	
TONTE CTOEN	A - UTSU	00700	TONT	C BALANCE !	CATTONS	(MOL.ED.	10.0924/	597				
TOUTO SUVEL	tuin - v	107172	TOWT	e pristines +	ANTONC	(MOL.ED.	10.10097	7204				
					DIEEEDE	WE 14	1 -5	2.70				
					DIFFER	11.5. 178	/	2 + 7 7				
CUCHTCAL CO	OTUCONOM	TEDE DES	00000 r		1000/T	DECEDERE KI	= 41011	1.95				
CUENTORE OF	LUTERNON	CIERO DEL	DREED C		1004/1	DEGNECO N	EFATH -	1,00				
DUADT7	2/5 1											
BUAKTZ	200+1											
CHALCEDUNT	999+9											
NAK	301.1											
									000	CU 107		
UXIDATION N	OTENTIAL	(VUL15)	1	ER H25= -0₊39	0 EH	CH4= 77+7	77 EF	1 HZ= 97.	444	EN NHS	= 77.777	
			THERE									
LOG SOLUBI	ITY PROD	UCTS OF I	MINERALS	IN DEEP WATE	A.					TEOD	041.0	
	TEO	R, CAL	LC.		TEOP	+ CALC	•	LUAL DRUT		IEUK.	CALU:	
ADULARIA	-14.3	71 99.9	999	ALBITE LOW	-13,93	8 99.99	7 I	ANALCIME	-	11+566	77.779	
ANHYDRITE	-8.4	41 -8.7	754	CALCITE	-13,24	2 -14,43	6 (CHALCEDON	IY .	-1+925	-2+043	
MG-CHLORITI	E -86.3	72 99.9	999	FLUORITE	-11.05	57 99,99	9 (GOETHITE		3,286	99,999	
LAUMONTITE	-24.7	17 99.9	999	MICROCLINE	-14.99	6 99.99	9	AGNETITE	-	15,172	99,999	
CA-HONTHOR	-72.5	80 99.9	999	K-MONTMOR.	-33.86	4 99,99	9 1	G-MONTHO	IR, -	74,086	99+999	
NA-MONTMOR	-34.1	46 99.9	799	MUSCOVITE	-17,83	8 99.99	9 F	REHNITE	-	37,960	99,999	
PYRRHOTITE	-10.7	19 00.0	999	PYRITE	-28.40	8 99.99	9 6	UARTZ		-2.031	-2,043	
HATRAKTTE	-24.0	3 00.0	299	UNU ASTONITE	7.19	9 4.10	7 7	OISITE	_	38,801	99,999	
SPINOTS	_70 A	70 00 0	200	MADCARTTE	-12 20	g 00 00	9	-VAVAIL		WTWYA	111/11	
and 16.2757.7 Sa.	201.11	41 1111	6-7.3C	ATTENDATION IN	36.761	* 11961	5					

ORKUSTOFN 1982-11-1	IUN JHD 2 Oliver		GEOCHEMISTRY OF	WELL PN-15D				
	28202112222 PUHAG	ian-1	.5D		S.NEGROS,PHI	LIPPINES P	UHAGAN	
PROGRAM W	ATCH1.							
WATER SAM	PLE (PPM)	00	TEAM SAMPLE					
PH/DEG.C	6+01/25+0) (GAS (VOL.%)		REFERENCE TEMP.	DEGREE	B C 274₊0	(MEASURED)
SI02	757.00	0	02	0.00				
NA	2800.00	+	125	0.00	SAMPLING PRESSURE	E BARS AL	BS. 4.8	
К	497.00	ł	12	0.00	DISCHARGE ENTHAL	PY MJOUL.	/KG 1.206	(MEASURED)
CA	63.10	0	12	0.00	DISCHARGE	KG/SI	EC. 78.7	
MG	0.260	1	CH4	0.00				
C02	154.00	N	12	0,00	MEASURED TEMPERAT	TURE DEGREES	3 C 0.0	
904	25.60				RESISTIVITY/TEMP	OHMM/DE	0.0	/ 0.0
H28	5.94				FH/TEMP.	AU/DEL	3.0 0.000	/ 0.0
CI CI	4945.00				harter i harte v	1117 2014	710 VIV00	VIV
5	4705:00	1	TTEDE GAS DED KR					
F DTCC COLT	DC 0.00	5	DUDENCATE /DCC C 4	0 00/05 0	MEACUDED DOUNL	IN C TEND	CUITD THE	01
V122+20FT	00100	L	UNDENSHIE/DEG+C 1	12+20/20+9	DEADORED DUWR	HULE IENF+	FLUID INFI	
AL.	00000				DEGREES C/P	HE LEKS	DEPTH (MET	EKS/
B	57.0000	-						
FE	0+0000	C	UNDENSATE (PPM)		0.0	0.0	0.0	
NH3	0+0000	P	H/DEG+C	0.00/ 0.0	0+0	0.0	0.0	
		C	:02	0.00	0.0	0+0	0.0	
		H	125	0.00	0.0	0.0	0.0	
		Ň	IA	0.00	0.0	0.0	0.0	
					0.0	0.0	0.0	
					0.0	0.0	0.0	
					0.0	0.0	0.0	
		C	ONDENSATE WITH NA	AOH (PPM)	0.0	0.0	0.0	
		C	02 2329	3.10	0.0	0.0	0+0	
		H	25 31	17,90	0.0	0.0	0.0	
IONIC STR	ENGTH = 0.14127		IONIC BALANCE :	CATIONS (M ANIONS (M DIFFERENCE	OL.EQ.)0.13736156 OL.EQ.)0.14154568 (%) -3.00			
DEEP WATE	R (PPM)			DEEP	STEAM (PPM)	GAS PRE	ESSURES (BAR	S ABS.)
0100	EE1 DA	000	5040 27	000	541011 75	000	0 120510	5
5102	331+70	002	3742+/3	002	341211.73	002	A 750E_A	1
NA	2041,17	123	66+31	H25	2931+30	120	0+737E-0	1
K	362,29	H2	0.00	112	0+00	n2 02		0 A
CA	46+00	02	0+00	02	0.00	02	0+000ET0	5
ńG	0.190	CH4	0.00	CH4	0.00	CH4	0+000E+00	
S04	18+66	N2	0+00	N2	0.00	N2	0.000E+0	0
CL	3619,17	NH3	0.00	NH3	0.00	NH3	0.000E+00	0
F	0.00					H20	0.586E+02	2
DISS.S.	0.00					TOTAL	0.716E+02	2
AL	0.0000							
В	41.5490			H20 ()	2)	0.09		
FE	0.0000			BOILI	NG PORTION	0,27		

APTTUTTY	PREETOTEN	TO TH DEED UATED	0					
HPUTATU	002FF101ER 0.492	KONA-	n 0.428	FF	11	0.149	EEU +	0.504
0U_	A 507	E_	A 507	55		0 074	AL LLL	0 074
UTOTOA	0+000		0.500	C 6	TTT	0.036	MLTTT AL OULL	0 150
100704	V+375	UL-	0.3/0	50	UNT COUNT	0+020	MLUNTT	0.700
H25109	V+133	RHT	V+370	r 1	(OH) 3-	0,620	AL (OH) 21	0,628
H2503-	0,000	N†	0+5/0	FE	(UH)4	0+14/	AL (UH)4-	0.608
HC03-	0.576	CA++	0+168	FE	011++	0+147	ALS04+	0,608
C03	0+137	NG++	0.209	FE	(OH)2+	0.628	AL(S04)2-	0.608
HS-	0.583	CAHC03+	0+641	FE	(OH)4-	0.628	ALF++	0.155
S	0.147	MGHC03+	0.596	FE	S04+	0.620	ALF2+	0.628
HS04-	0.608	CAOH+	0.641	FE	CL++	0.147	ALF4-	0.608
504	0.125	MGOH+	0.650	FE	CL2+	0.620	ALF5	0.137
NAS04-	0.628	NH4+	0.555	FE	CI.4-	0.596	ALF6	0.011
CHEMICAL (COMPONENTS	IN DEEP WATER ((PPM AND LOG M	IN F)				
H4 (ACT.)	0.00	-5,398	MG++	0.18	-5.140	FF(OH)3	0,00	0.000
OH-	0.07	-5.394	NACI	494.54	-2.080	FE(OH)A-	0.00	0.000
HACTOA	202.10	-2.027	XCI	100:01	-7.701	EEU T	0.00	0.000
1170104 1170104-	002477	-2003/	NGC NACOA	07+£0 A 10	-3+301	FEDLT FERLO	0.00	0 000
000104-	0+20	-0+0/2	Keoy	7+10 A E4	-1+400 -1-1-77	FEGL2	0.00	0+000
HAU7070A	0.00	-11:001	NSU4-	4:01	-4,64//	FELLTT	0.00	0.000
NAH35104	0+14	-3,911	CASU4	2+39	-4./55	FECL2+	0+00	0,000
H3B03	237+57	-2.415	MGSO4	0+03	-6.554	FECL3	0.00	0,000
H2B03-	0.07	-5.921	CAC03	0.03	-6.574	FECL4-	0.00	0+000
H2CO3	8319.67	-0.872	MGC03	0.00	-9,999	FES04	0.00	0.000
HC03-	39.66	-3,187	CAHC03+	26.06	-3.589	FES04+	0.00	0.000
003	0.00	-8.617	MGHC03+	0.01	-6+820	AL+++	0.00	0.000
H2S	87,75	-2.589	CAOH+	0.02	-6.539	ALOH++	0.00	0.000
HG-	0.73	-4.653	MGOH+	0.01	-6.899	AL (0H)2+	0.00	0.000
C	0.00	-13.474	NHANH	0.00	0.000	AL (OH) 3	0.00	0.000
LOCUV	0.00	-10.707	MIAL	0.00	0.000	AL (0H) 4-	0.00	0.000
12004	2 20	-101700	RUAT	5 00	0 000	AL COAL	0.00	0.000
004	2+00	-4+JZ/	FETT FELL	0.00	0.000	AL (COA)O	- 0.00	0.000
304	1+30	- 000	FETTT	0040	01000	HELOUT/2	- 0,00	0 000
rir -	0.00	0.000	FEURT	0.00	0.000	HLFTT	0+00	01000
	0.00	0.000	FE(UH)2	0.00	0.000	ALF 21	0.00	0.000
CL-	3306+31	-1,030	FE(0H)3-	0+00	0+000	ALF 3	0.00	0+000
NAt	1848.97	-1.095	FE(0H)4	0.00	0,000	ALF4-	0.00	0+000
K+	341,44	-2.059	FE(OH)++	0.00	0.000	ALF5	0.00	0.000
CA++	34.94	-3.060	FE(OH)2+	0.00	0+000	ALF6	0.00	0.000
IDNIC STRE	ENGTH = 0	.09360 IONI	C BALANCE :	CATIONS	(MOL.EQ.)	0.09117395		
				ANIONS	(MOL,EQ.	0.09410425		
				DIFFERE	NCE (%) -3.16		
CHEMICAL I	SEATHERMOM	ETERS DEGREES C		1000/T	DEGREES KI	ELVIN = 1.83		
QUARTZ	266.5							
CHALCEDON	Y 999.9							
NAK	268.6							
OXIDATION	POTENTIAL	(VOLTS) :	EH H2S= -0.45	2 EH	CH4= 99₊99	79 EH H2= 99	.999 EH N	H3≈ 99₊999
0.00 2011121	TTY PRON	ICTS OF UTNEDALS	TH DEED WATE	D				
200 000000	TEAC		AN DELL WITH	TEOP	CALC		TEOP	CALC
ATEL ADTA	ILUP		ALDITE LOU	17 04	* UMLU		-11 50	7 00 000
AUUVADATE	-14+3/	6 77+777	PLDIIC LUN	-13.79	2 77+77	7 HRHLLIPE	-11+38	77+777
MANTUKITE	-8.00	-8,83/	LALGITE	-13+40	1 -13.310	D CHALLEUU	-1.70	< =Z+V3/
MG-CHLORIT	E -86,9(13 99+999	FLUORITE	-11,09	1 99+999	9 GUETHITE	3.63	1 99.999
LAUMONTITE	-24.78	32 99.999	MICROCLINE	-14.98	2 99.99	7 MAGNETITI	E -14,57	5 99,999
CA-MONTHON	R72.56	30 99.999	K-MONTMOR +	-33,83	0 99 +99	9 MG-MONTM	OR, -74.08	4 99,999
NA-MONTMOR	R34.11	15 99+999	MUSCOVITE	-17.84	0 99.999	9 PREHNITE	-38.19	3 99+999
PYRRHOTITE	-7.3	3 99.999	PYRITE	-24.06	0 99.99	9 QUARTZ	-2.00	7 -2.037
WAIRAKITE	-25+04	19 99.999	WOLLASTONITE	7.09	4 4.92	1 ZOISITE	-39.10	6 99,999
EPIDOTE	-38,87	71 99.999	MARCASITE	-8.04	1 99.99	9		

ORKUSTOFNU 1982-11-12	IN JHD 2 OLIVER		GEOCHEMISTRY OF	WELL PN-17	D	82233333		-222-01-04			**************
XXXXXXXXX820131XXXX PUHAGAN-17D						S.NEGROS, PHILIPPINES PUHAGAN					
PROGRAM WA	TCH1.										
WATER SAMP	LE (PPM)		STEAM SAMPLE								
PH/DEG.C	6+21/25+	0	GAS (VOL.%)		REFI	ERENCE TI	EMP+	DEGREE	SC	245.0	(MEASURED)
SI02	559.00		C02	0.00							
NA	2965.00		H2S	0.00	SAM	LING PRI	ESSURE	BARS A	BS.	6.6	
K	421,00		H2	0.00	DIS	CHARGE EI	NTHALPY	MJOUL	./KG	1,094	(MEASURED)
CA	68.60		02	0.00	DIS	CHARGE		KG/S	SEC.	33.4	
MG	0.420		CH4	0.00							
0.02	40.20		₩2	0.00	MEA	SURED TEN	MPERATI	IRF DEGREE	S C	0.0	
904	30.40		11.00		RES	ISTIUITY	/TEMP.	OHMM/DI	-G.C	0.0	/ 0.0
1125	7.14				EH/	TEMP.	/ 14-10 /	MU / DE	0.0	0.000	/ 0.0
C1	4417.00				1m11/	L.11) 1		1147 84	.0+0	0.00001	0+0
C.	0.00		I TTEPS GAS PER KE								
DICC COLTD	C 0.00		CONDENSATE /DEC P	10 40/25 0	3	EACHDER	ากมุมมาก	HE TEMP	FUIT	D THE	nu
D199+90F10	DULIUS 0:00 CUMDENSHIE/I			10+40/20+0	1	DECODEL		TEDE	DEDTU	U INFL	DC \
PL	0+0000 ET 7000					DEGRE	cə 6/ne	ICNO	DEFIC	1 (11210	LNO/
D	0006+66		DOMOGNOATE ZOOMS					A A		A A	
FE.	0.0000		LUNDENSAIE (PPH)			V+\	2	0.0		0.0	
NH3	0+0000		PH/UEG+C	0.00/ 0.0		0+0	0	0+0		0.0	
			C02	0.00		0+(0	0.0		0+0	
			H25	0.00		0.0	0	0.0		0.0	
			NA	0.00		0.()	0.0		0+0	
						0.(0	0.0		0.0	
						0.0	9	0.0		0.0	
						0.0	0	0.0		0.0	
			CONDENSATE WITH NACH (PPM)			0+0	0	0.0		0.0	
			CO2 19184.00			0.0	D	0.0		0.0	
			H25 3	27.80		0.0	0	0.0		0.0	
IONIC STRE	NGTH = 0.13896		IONIC BALANCE :	CATIONS ()	HOL.EC	1.)0.1428	38795				
				MATONO ()	-	4/V+1014 WA	0 /7				
				DIFFERENCE	E 1	4)	010/				
DEEP WATER	(PP計)			DEEP	STEAM	(PPM)		GAS PR	ESSURES	(BARS	ABS.)
SI02	457.71	C02	874.01	C02	1	51280.00)	C02	0.2	26E+01	
NA	2427+52	H28	34.86	H2S		1852.17	7	H2S	0.3	58E-01	-
K	344.67	H2	0,00	H2		0.00)	H2	0.0	00E+00	
CA	56.16	02	0.00	02		0.00	3	02	0.0	00E+00)
MG	0,344 CH4 0.00		CH4	CH4 0.00)	CHA	0.0	0.000E+00		
504	25.05 N2 0.00 N2		N2		0.00)	N2	(2 0+000E+00)	
C1.	23+03		7 0.00 1117			0.00		NHZ	0.000F+00		
c C	0//7+/0 N		a 0,00 NH3			V+VV		120	0.365E402		
DTCC C	0.00							TOTAL	0.7	RREINS	
V1 0100+01	0.000							TOTAL	V+3	VUL TV2	9
D D	17 1710			400 /	(7)		1	04			
5	43+6340		HZU (1/1/	4/		1+70			
FE	0.0000			BOIL	ING PC	NUTION	0	+18			

ACTIVITY	COEFFICIEN	TS IN DE	EP WATER								
Ht	0.706		KS04-	0.445	1	FF11	0.101	EEC1 1		0 /17	
OH-	0.601		F-	0.401	, i	EETTT	0.047	VITT		0 047	
H3SI04-	0.613		C1 -	0.587	-	CEUNT	0.474	AL OULL		0 177	
H2ST04	0.177		NA4	0.417	3	EC/0417_	A 171	AL COUNTY	21	V+1//	
H2803-	0.573		K4	0.597	1	E(00)/3-	0,030	AL (OU)	2T A-	V+093	
HC03-	0.413		C011	0 101		CC0014	0.140	ALCOAL	4-	V+02J A /2E	
C07	0.157		MGLL	0 974		EUNTT	0,100	RL3U9T	10	V+020	
HC-	0.401		CAUCOTL	0+204		ELUN/2T	0+043	ALC:04	12-	V+020	
Carr	0 140		GMAGUCOZI MCUCOZI	V+0J0		CON/4-	0,043	HLFTT		V+1//	
UCOA_	V+100		CADUL	V+013		EDU4T	0.030	HLF 27		0+040	
004	0+020		LAUNT	V+606	1	EULTT	0.168	ALF 4-		0+625	
204	0+145		nguht	0.666	ł	ECL24	0+636	ALF5		0.157	
NR504-	0+645		NH4+	0.5/3	ł	ECL4-	0,613	ALF6	- 1	0.016	
CHEMICAL	COMPONENTS	IN DEEP	WATER (PI	PM AND LOG	MOLE)						
H+ (ACT.)	0.00	-5,499	WICOMENCI WEI	MG4+	0.32	-4,880	FF(OH)2	0	.00	0.000	
OH-	0.08	-5.343	1	VACI	307.64	-2.279	FF (DH)A	- 0	.00	0.000	
HASTOA	731.58	-2.119		KCL	21.44	-7.541	FECI +	0	.00	0.000	
UZGIDA-	0.74	-5.451			4. 17	-1.247	FECI 2	0	.00	0.000	
UDOTO4-	0.00	-10 017		Kent-	A 17	-1 511	LEGES	0	+00	0.000	
MAUZETOA	0.20	-5 4010		CACOA	7 90	-4 547	FECT 21	0	+00	0,000	
NH030104	240 44	-3+020		UCCO A	0 A A	-4 117	FEULZT	0	+00	0.000	
10007	297+90	-2+374 E 774		00007	0+07	-4 050	FEGLO	0	+00	0.000	
H2003-	1000 04	-3+/31		LAPPO2	0+01	10.000	FEULS	0	+ 00 +	0+000	
H2003	1207+74	-1+/10		NUGUJ NAUCO71	10.10	-10+020	FEDU4	0	400	0.000	
HLU3-	10+40	-3+375		UNITLUOT	10+12	-4.000	FEBUNT	V	+00	0.000	
LU3	0.00	-8+64/		NUMLU31	0+01	-/+086	ALTT	U	+00	U+UUU	
H25	34.0/	-3.000		CAUNT	0+02	-6+49/	ALUH++	0	+00	0+000	
HS-	0+76	-4+638		MGOHt	0.00	-6+997	AL(OH)2	4 0	•00	0+000	
S	0.00	-13,557		NH40H	0.00	0.000	AL(0H)3	0	•00 (0,000	
H2S04	0.00	-11+255	1	NH4+	0.00	0.000	AL(OH)4	- 0	+00	0.000	
HS04-	1.46	-4.823	1	FE++	0.00	0.000	ALS04+	0	•00 (0.000	
S04	12.63	-3.881		FE+++	0.00	0.000	AL(S04)	2- 0	.00	0.000	
HF	0.00	0.000	1	FEOH+	0.00	0.000	ALF++	0	+00	0.000	
F-	0.00	0.000		FE(OH)2	0.00	0.000	ALF2+	0	.00	0.000	
CL-	3582.92	-0,995		FE(OH)3-	0.00	0.000	ALF3	0	.00	0.000	
NAt	2305+20	-0,999		FE(0H)4	0.00	0.000	ALF4-	0	.00	0.000	
K+	332.22	-2.071	1	FE(0H)++	0.00	0.000	ALF5	0	+00	0.000	
CA++	50.99	-2,895		FE(OH)2+	0.00	0.000	ALF6	• 0	.00	0.000	
IONIC STRENGTH = 0.10795 IONIC BALANCE : CATIONS (MOL.E0.)0.11143742 ANIONS (MOL.E0.)0.10161908 DIFFERENCE (%) 9.22											
CHEMICAL	GEOTHERMON	ETERS DE	GREES C		1000/1	DEGREES N	KELVIN = 1.93				
QUARTZ	244.5										
CHALCEBON	Y 999.9										
NAK	236.5										
OXIDATION	POTENTIAL	(VOLTS)	; E	H H2S= ∼0,4	¥23 Eŀ	I CH4= 99.9	999 EH H2= 9	9,999	EH NH3	= 99,999	
LOG SOLUI	BILITY PROD	UCTS OF	MINERALS	IN DEEP WAT	TER	R. CAL	r.		TEOR.	CALC.	
ADDE ADTA		00 00	000	AL RITE LOU	-17.0	249 99.00	99 ANAL CTA	(F -	11.525	99,999	
ANUVERTH	-0.0	14 -0	77.4	CALCTTE	-12.4	42 -17.04	67 CHALCET	INY	-2,015	-2.119	
HNRTDKILL	-3.U.	1-7 -04	000	CHLOITE	-12+0	00 00 00	00 0057073	E	1.000	00,000	
MG+LHLUR)	11E -84.50	V3 77+	777	FLOOKITE	-10+2	AE 00 00		TE	17 410	00 000	
LAUMONTI	E -24.54	40 99.	777	TILKULLINE	-12+1	103 77.7	77 MAUREIS	THOP -	74 447	77+777	
CA-MONTH(JR+ -72+6	13 99.	999	K-MUNIMUR.	-34+(JIZ 99.99	77 NU-NUN	HUR: -	77+113	77+777	
NA-MONTHE	sk -34.28	56 99+	999	NUSLOVITE	-1/+8	548 99.99	PREHRIT	E -	3/+162	77 + 777	
FYRRHOTIT	E -23+84	41 99.	999	PIRITE	-44.9	721 99.99	VY WUARTZ	a	-2+126	-2+119	
WAIRAKITE	-24+45	59 99.	999	HULLASTONIT	E 7,5	368 5,26	SD ZOISITE		3/ 137	79 ₊ 999	
EPIDOTE	-37.3	18 99+	999	MARCASITE	-27+9	93 99.99	79				