GEOLOGY AND GEOCHEMISTRY OF MATALOKO GEOTHERMAL FIELD CENTRAL FLORES – EAST NUSA TENGGARA

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ABSTRACT

The Mataloko geothermal Field is situated in the East of Bajawa, the capital city of Ngada District, East Nusatenggara. The thermal features associate with post volcanic activity and the area is surrounded by active volcanoes of Inerie in the southwest, Inelika in the northwest and Ebulobo in the East.

Base on volcanism activities, the local stratigraphy sequence can be divided into three main parts of volcanic product : the Tertiary volcanic rocks (3.7-2.4 ma) as basement, Old volcanic rocks of Quaternary (1.1-1.6 ma) and younger Quaternary volcanic rock (0.17-0.2 ma)

The Mataloko thermal feature are likely controlled by the northwest-southeast trending Waeluja normal fault. These include fumaroles, steaming grounds, mud-pools, high temperature of acid sulfate water and argillic-advanced argillic type of alteration rocks. The high sulfate, low chloride spring water type and high anomaly of Hg and CO2 gas around this area suggest that the feature area is probably as an up flow zone of the Mataloko geothermal system.

The Mataloko geothermal heat sources were deduced from Wolo Belu lava dome and some volcanic cones which are located at the surrounding of the Mataloko geothermal manifestation

1. INTRODUCTION

The Mataloko geothermal area is situated about 10 Km east of Bajawa, capital city of Ngada district and lies between 121° 00' – 121° 05' E longitude, 08° 48' 30" to 08° 53'30" S latitude **(Figure-1)** The area lies in inner Banda arc which comprises Upper Cannozoic calc-alcalic volcanic rock (Hamilton,1979).

Inventory of geothermal manifestation and preliminary geological mapping were done by Muksin (1975), Akbar (1984), Sutoyo (1994) and Nanlohy et.al (1997, 1998). The recent investigations are conducted by New Energy and Industrial Technology Development Organization (NEDO), Geological Survey of Japan (GSJ) and Volcanological Survey of Indonesia (VSI), in 1998,1999 and 2000.

The Mataloko geothermal prospect dominantly consists of andesitic to basaltic lava flow and pyroclastic deposits. Characteristic cone structures phenomena can be recognized in the area.

Active tectonic developed during Tertiary to Quaternary, effected fault and volcanic lineament, which some of volcanic cones appear from this structures. Most important of the main fault structure is NW-SE trending of Waeluja normal fault. Mataloko geothermal manifestation is controlled by this structure and the heat source most likely come from Wolo Belu lava dome.

2. GEOLOGY

Three period of volcanic activities during Tertiary to Quaternary age were identified in Mataloko geothermal field **(Figure-2)**.

Tertiary volcanic rocks (2.4 - 2.3.7 ma) were presented by green tuff and Watumanu lava flows as a basement rocks in Mataloko geothermal field.

The second period of volcanic activities were shown by old volcanic (1.1 - 1.6 ma) of Rotogesa volcanic (lava flow, pyroclastic flow and laharic deposit), Wolo Pena volcanic cone, Wolo Roge, Wolo Sasa, and Wolo Pure volcanic cone.

The younger volcanic activities were presented by young volcanic cones and Wolo Belu lava dome, which formed the NW-SE trend of volcanic lineament from Inelika volcano to south of Mataloko area.

Those young volcanics were deduced as a heat source of Mataloko geothermal field. The Tertiary volcanic rocks of green tuff and Watumanu lava flows were suggested as a reservoir rocks.

The phenomena of young volcanic cones which are distributed at surrounding Mataloko geothermal field indicate that the area is used to be an active tectonic. Almost all of the volcanic cones have been controlled by fractures of fault systems and those young volcanic vents have a crater from 100-500 meter in diameter. At least there are four normal fault structures distributed in the Mataloko geothermal field, indicated by hot spring lineaments, triangular faced and scarbs. The most important fault in which surface thermal manifestation appearance is NW-SE trend of Waeluja normal fault. Another structure phenomena is volcanic lineament which have a variable trending from NW-SE to NE-SW **(Figure-2)**. This volcanic lineament indicates development of eruption center and it is very helpful to indicated the heat source of Mataloko geothermal field.

3. THERMAL FEATURES

All of the surface thermal manifestations appear in Waeluja/Waebeli river including fumaroles, steaming grounds, mud pools and high temperature of acid sulfate type of hot

springs. Temperature measurement of thermal manifestation is 40°-98°C, pH=3 and hot spring have a flow rate less than 0.5 LPM.

The appearance of this thermal manifestation was controlled by NW-SE trend of Waeluja normal fault. Surface hydrothermal alteration distributed around Waeluja river, north foot of Mt.Wolo Nawa, Wolo Rhea and around Were village. The active alteration only around Waeluja river. Classification of alteration zone in this area, base on x-ray analysis of 20 alteration rock samples. The alteration have an argillic to advance argillic type and can divided into 4 alteration zone, alunite, kaolinite, Montmorillonite and weakly altered to fresh rock zone. The alunite zone probably as the up flow of hydrothermal fluids in this area.

4. GEOCHEMISTRY

Hot water type in the study area is an acid sulfat water with reservoir temperature from gas geothermometer of 283°C.
The triangle diagram of water type from Cl, SO4 and HCO3 contain, shows that the hot water come from steam heated waters **(Figure-3)**. 18 oxigen and deutrium from hot water show that the spring have come from meteoric water.

Soil mercury (Hg) contain taken from the depth of 1 meter have a variable from 105 – 458 ppb. From air soil we have 0.72-1.0 % of CO2 contain. The anomaly of Hg and CO2 about 1 Km2 spread around the discharged area of Waeluja river.

5. CONCLUSION

The stratigraphic of the Mataloko geothermal field have derived from Tertiary to Quaternary of volcanic activities. The most important of the geological structure is NW-SE trend of Waeluja normal fault as a controlled of thermal manifestation. The thermal feature including fumaroles, steaming ground, mud pool and high temperature of acid sulfate water have a temperature of 40°-98° C, pH=3 and low flow rate.The hot spring derive from meteoric water is steam heated water and have a reservoir temperature of 283° C. Mercury have a variable contain from 105-458 ppb and CO2 contain of air soil is 0.72-1.0%. High anomaly of Hg and CO2 about 1 Km2 spread around the discharge area of Waeluja river.

The heat source probably come from lava dome of Wolo Belu and some volcanic cones surrounding area. The green tuff and Watumanu lava flows were suggested as a reservoir rocks.

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Fig. 1. Location of Mataloko Geothermal Field

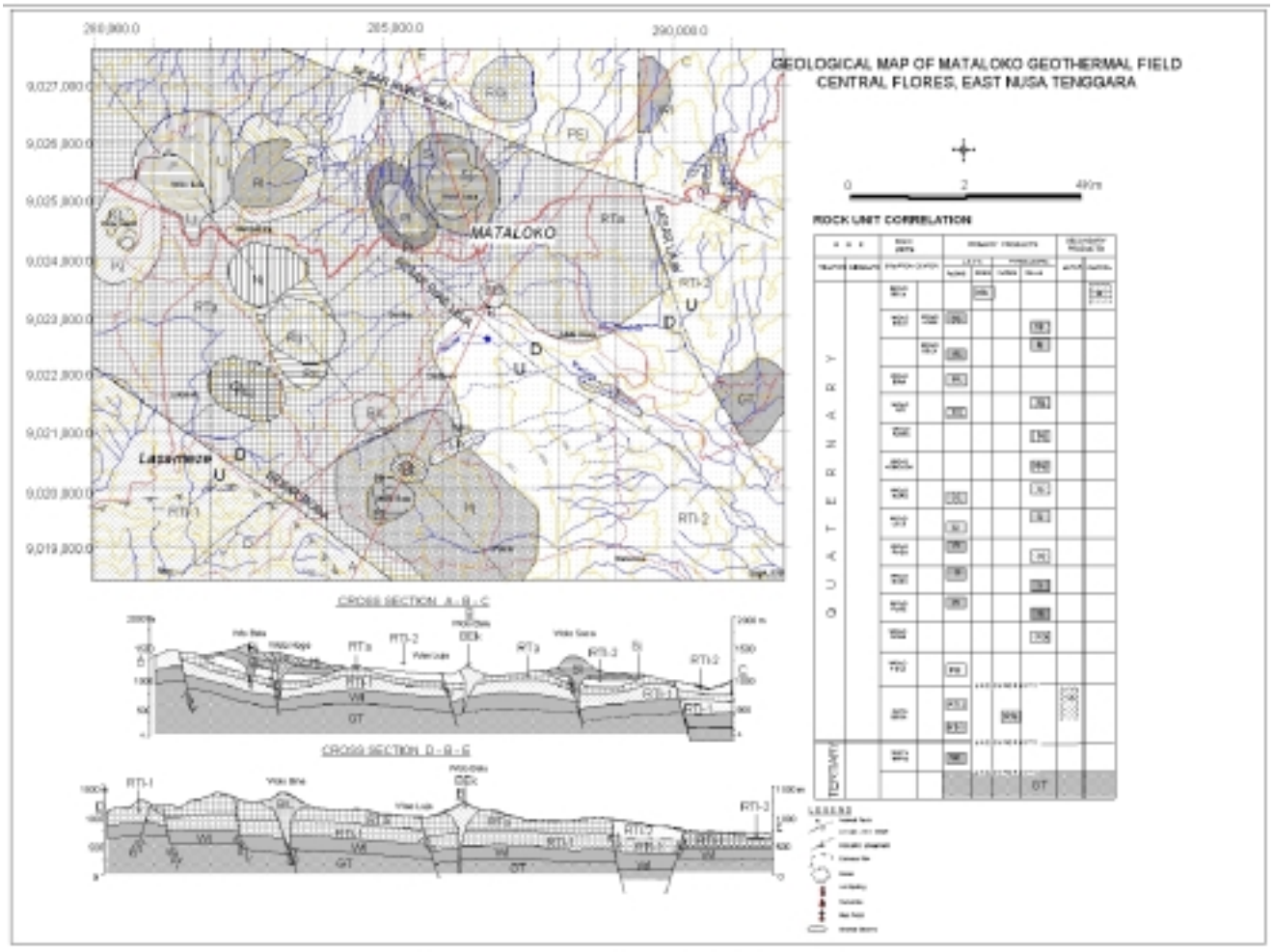
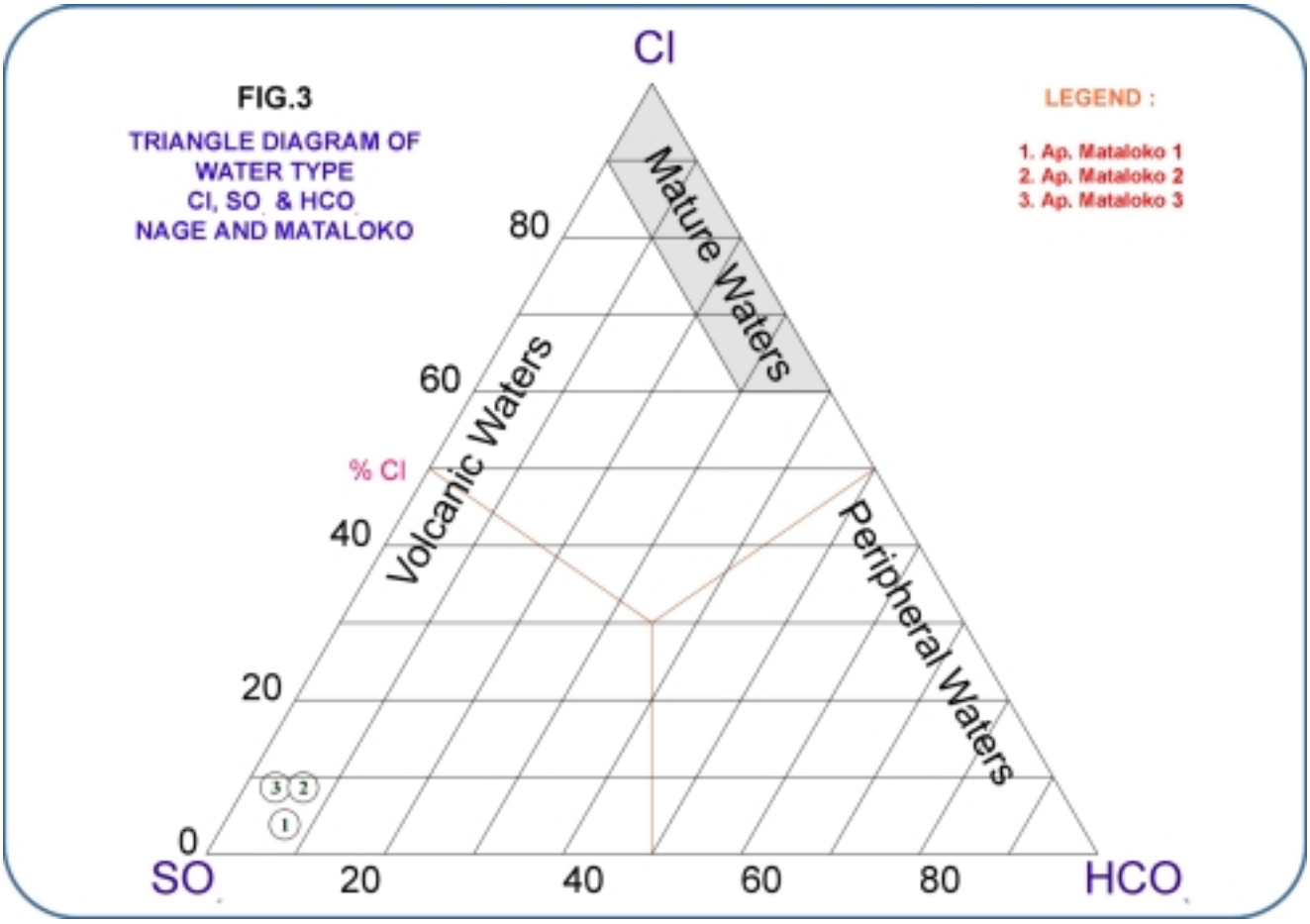


Fig.2 Geological Map of Mataloko Geothermal Field Central Flores, East Nusa Tenggara


Cl
FIG.3
TRIANGLE DIAGRAM OF
WATER TYPE
Cl, SO & HCO
NAGE AND MATALOKO
LEGEND :
1. Ap. Mataloko 1
2. Ap. Mataloko 2
3. Ap. Mataloko 3
Mature Waters
Volcanic Waters
Peripheral Waters
% Cl
80
60
40
20
0
SO
20
40
60
80
HCO
3
2
1