ACTIVE VOLCANIC AND GEOTHERMAL GASES CASE STUDY OF GEOTHERMAL AND SORIK MARAPI VOLCANIC AREA, MADINA DISTRICT, NORTH SUMATRA INDONESIA

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ABSTRACT

The Sorikmarapi Volcano (2145 m asl.) and its geothermal field are located approximately 22 km to the north part of Panyabungan, the capital city of Mandailing-Natal District, part of North of Sumatra Province, Indonesia.

After more than 400 years, there was no magmatic eruption occur. However, the phreatic eruptions are usually occur until present. The last phreatic eruption at the summit crater was occur in1986. The next year (1987), the eruption occurred at Fumarole field, on the northeast flank of volcano.

The released small amounts of gases from Sorik Marapi solfatara on the low part crater rim are function of deep magma process, eq. vapour melt separation during coming up generating magma. The existence SO_2 indicates a high temperature magmatic component, rising from underlying magma. On the other hand, the flank of this volcanic fumaroles have no SO_2 gas, high H_2S and CO_2. The existence H_2S assumed a low temperature gas presenting at the reservoir. The H_2, O_2+Ar, CH_4, and NH_3 gases probably indicate a secondary hydrothermal component slowly rising from a two phase, saline brine vapour, and covering the magmatic system.

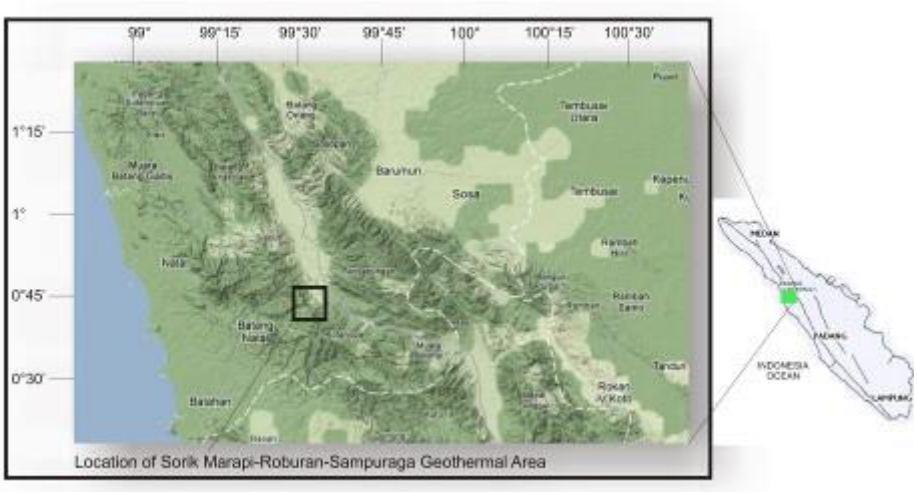
The H_2 to CH_4 and NH_3 shows a decreasing in equilibration for individual species, interpreting slow rate varieties (CH_4 and NH_3) are formed at depth within the hydrothermal zones. The rapidly rising magmatic component are controlled by the SO_2-H_2S bupper. The H_2S and CH_4 seems to be stable in low temperature rock conditions, particularly at the geothermal reservoir, outside of Sorik Marapi volcanic vent.

The acidic conditions within the hydrothermal zones of the Sorik Marapi Crater Lake indicate a high temperature fluid interaction toward surface, where SO_2 and H_2S reacts with rocks. However, deep drillings to the geothermal reservoir, which is located northern part of outside the Sorik Marapi volcano represent neutral chloride fluids, supporting 2 x 20 MW power plants.

Gas ratio and geothermometry indicate steam derived from a deep source, with temperature

200^{o}C-230^{o}C. While, at the lower part of the crater, the subsurface temperature is probably more than 400^{o}C, indicating by present of SO_2 gases.

Keywords: Solfatar, fumarole, Gas Geochemistry, Sub Surface temperature, Geothermal wells.



Location map of Sorik Marapi geothermal area

The Sorik Marapi volcano, Madina District , North Sumatra

The fumarole field of geothermal area, located at northeast flank of Sorik Marapi volcano.