SARI

GEOLOGI DAN SISTEM PANAS BUMI LAPANGAN "SIBOHI" DAERAH PAHAE JAE DAN SEKITARNYA , KABUPATEN TAPANULI UTARA, SUMATERA UTARA

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Pulau Sumatra memiliki banyak potensi sistem panas bumi, sistem sesar mendatar *Great Sumatra Fault* menunjukkan hal yang unik yaitu mengontrol dan mempengaruhi aktivitas sistem panas bumi. Penelitian sistem panas bumi pada lapangan "Sibohi" bertujuan untuk mengetahui zona alterasi, zona *clay cap* dan reservoir, temperatur reservoir, sumber panas, fluida geokimia reservoir daerah penelitian. Analisis yang digunakan berdasarkan data laporan lapangan internal meliputi data *mud log*, MeB (*Methyleneblue*), PT (*Pressure Temperature*), dan analisis geokimia fluida melalui empat sumur pengeboran yang terdiri dari sumur R, sumur P, sumur Q, dan sumur S. Geologi lapangan "Sibohi" memiliki geomorfologi berupa dataran rendah struktural hingga perbukitan tinggi struktural, stratigrafi pada daerah penelitian terdiri dari Quarternary Alluvium & Sediments, Quarternary Rhyollite, dan Paleozoic Meta-sediments. Berdasarkan data *mud log* litologi bawah permukaan terdiri dari Formasi Tuf Toba (Qvt) didominasi batuan riolit tuf serta sisipan batulempung, dan Formasi Dasit (Qd) dan zona alterasi daerah penelitian terbagi menjadi dua yaitu zona alterasi Argilik yang menurut Reyes (1990) zona ini ditandai dengan mineral illit, kaolinit, serta smektit dan zona alterasi Silisifikasi yang ditandai dengan mineral illit. Sistem panas bumi memiliki batas zona *clay cap* dan reservoir pada kedalaman -486 sampai -590 mdpl berdasarkan data *mud log* dan MeB. Kemudian temperatur reservoir diperoleh suhu berkisar 160°C-300°C berdasarkan perajahan mineral sekunder dan data *PT*. Sumber panas terletak di bawah *Great Sumatra Fault* dan diinterpretasikan sumber panas terletak dekat dengan sumur P dan Q dimana memiliki suhu yang paling tinggi dan dijumpai paling banyak fumarol. Karakteristik fluida geokimia panas bumi memiliki tipe fluida klorida, yang pada umumnya menandakan fluida berupa air reservoir dan indikasi zona *permeable* dan sebagai zona *upflow*, kematangan fluida memiliki suhu 270-320°C dimana konsentrasi Mg yang lebih rendah menandakan bereaksinya fluida dengan batuan reservoir, dan hasil analisis isotop fluida menunjukan bahwa fluida panas bumi berasal dari air meteorik dengan percampuran air magmatik ataupun air andesitik. Zona upflow merupakan permeabilitas tinggi di zona *Great Sumatra Fault* dan akifer sub-horizontal dengan permeabilitas rendah yang meluas secara lateral kemudian fluida mengalir secara vertikal melalui sesar dan menyuplai manifestasi di permukaan.

Kata kunci : Pahae jae, alterasi, argilik, silisifikasi, panas bumi, *great Sumatra fault*

ABSTRACT

GEOLOGY AND GEOTHERMAL SYSTEM OF "SIBOHI"PAHAE JAE AND SOURROUNDINGS, NORTH TAPANULI DISTRICT, NORTH SUMATRA

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Sumatra Island has many geothermal system potentials, the strike-slip fault system of the Great Sumatra Fault shows a unique thing that it controls and influences geothermal system activity. Geothermal system research on "Sibohi" field aims to know the alteration zone, clay cap zone and reservoir, reservoir temperature, heat source, geochemical fluid reservoir of research area. Analysis used based on internal field report data include mud log data, MeB (Methyleneblue), PT (Pressure Temperature), and geochemical analysis of fluids through four drilling wells consisting of R wells, P wells, Q wells, and S wells. The geology of "Sibohi" field has geomorphology in the form of structural lowlands up to structural high hills, stratigraphy on research areas composed of the Quarternary Alluvium & Sediments, Quarternary Rhyollite, and Paleozoic Meta-sediments. Based on mud log data, the subsurface litologies consisted of Tuf Toba Formation (Qvt) dominated by tuff rhyolite rocks as well as clay inserts, and Dasit Formation (Qd) and alteration zones of research area divided into two namely Argilic alteration zones which according to Cathelineau and Elders (1981) these zones are characterized by illit minerals, kaolinite, as well as smectite and Silicification alteration zones are the one marked by illit minerals. The geothermal system has a limit of the cap clay zone and reservoir at depths of -486 to -590 masl based on log and MeB mud data. Then reservoir temperatures obtained temperatures ranged from 160°C-300°C based on secondary mineral plotting and PT data. The heat source is located under the Great Sumatra Fault and is interpreted that the heat source is located close to the P and Q wells where it has the highest temperature and encountered the most fumaroles. The geochemical fluid characteristics of geothermal has a chloride fluid type, which generally signifies the fluid is in the form of reservoir water and indication of a permeable zone and as an upflow zone, fluid maturity has a temperature of 270-320°C where the lower concentration of Mg signals the reaction of fluids with reservoir rocks, and the result of fluid isotope analysis indicates that geothermal fluids are derived from meteoric water with a mixture of magmatic or andesitic water. The upflow zone is a high permeability in the Great Sumatra Fault zone and sub-horizontal aquifers with a low permeability that extends laterally then the fluid flows vertically through the fault and supplies manifestations on the surface.

Keywords: Pahae jae, alteration, argillic, silicification, geothermal, great Sumatra fault