

## SARI

### **PENENTUAN ASAL DAN ALIRAN FLUIDA PANAS BUMI BERDASARKAN DATA ISOTOP STABIL DAN GEOKIMIA FLUIDA MANIFESTASI, DAERAH GUNUNG LAWU**

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Daerah penelitian berada di Kabupaten Karanganyar dan Sragen, Provinsi Jawa Tengah serta Kabupaten Magetan dan Ngawi, Provinsi Jawa Timur. Luas daerah penelitian sekitar 391,5 km<sup>2</sup>. Manifestasi yang muncul berupa 10 mata air panas di Pablengan, Cumpleng, Tasin, Nglerak, Jenawi, Mangli, Ngunut, Bayanan, dan Condrodimuko, serta fumarol di Condrodimuko. Penelitian ini bertujuan untuk mengetahui tipe dan suhu reservoir, serta menentukan asal dan aliran fluida panas bumi Gunung Lawu agar membantu dalam tahap pengembangan.

Geomorfologi daerah penelitian terdiri dari satuan punggung aliran lava Gunung Jobolarangan berlereng terjal, satuan punggung aliran lava Gunung Lawu berlereng terjal, satuan aliran piroklastik berlereng sedang, dan dataran aluvial. Stratigrafi dari tua ke muda terdiri dari satuan Intrusi Tawangmangu, satuan batugamping, satuan Lava Jobolarangan-1, satuan Lava Jobolarangan-2, satuan aliran piroklastik Gunung Jobolarangan, satuan Lava Jobolarangan-3, satuan Gunung Lawu-1, satuan Lava Ceto, satuan Lava Gunung Lawu-2 hingga satuan lava Gunung Lawu-6, satuan aliran piroklastik Gunung Lawu, satuan Lava Gunung Purung, satuan Lava Gunung Lawu-7, satuan Lahar Gunung Lawu, dan satuan aluvium. Struktur geologi yang ada berupa rim kawah, sesar normal berarah relatif barat-timur dan tenggara-baratlaut, dan sesar mendatar berarah baratdaya-timurlaut.

Hasil analisis geokimia menunjukkan tipe air panas Pablengan dan Tasin merupakan tipe klorida, air panas Ngunut dan Bayanan merupakan tipe klorida encer, air panas Nglerak, Mangli, dan Jenawi-2 merupakan tipe klorida-sulfat yang telah mengalami pengenceran oleh air meteorik. Suhu reservoir di bawah mata air panas Pablengan sebesar 150,1°C dan Tasin 173°C. Sistem panas bumi daerah penelitian termasuk sistem yang relatif tua. Fluida manifestasi berasal dari dua reservoir berbeda dan fluida panas bumi berasal dari air meteorik yang telah mengalami pencampuran dengan *andesitic water*. Zona *upflow* berada di daerah fumarol Condrodimuko, sedangkan daerah Tasin merupakan zona *outflow* yang masih berada di dekat zona *upflow* dan mata air panas lainnya adalah zona *outflow*.

**Kata kunci:** Geokimia fluida, isotop, asal fluida, arah aliran fluida, Gunung Lawu, Panas Bumi.

## ABSTRACT

### DETERMINATION OF ORIGIN AND GEOTHERMAL FLUID FLOW BASED ON STABLE ISOTOPES AND GEOCHEMICAL FLUID MANIFESTATIONS DATA, Mt. LAWU

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*The research area is located in Karanganyar and Sragen, Central Java, Magetan and Ngawi, East Java Province. The wide area of research is around 391.5 km<sup>2</sup>. Manifestations that appears in the form of 10 hot springs in Pablengan, Cumpleng, Tasin, Nglerak, Jenawi, Mangli, Ngunut, Bayanan, Condrodimuko, and fumaroles in the area Condrodimuko. This study aims to determine the type and temperature of the reservoir, as well as determine the origin and flow of geothermal fluid Lawu in order to assist in the development stage.*

*Geomorphology study area consists of lava flow ridge of Mount Jobolarangan with steep slopes unit, lava flow ridge of Mount Lawu with steep slopes unit, moderate slopes pyroclastic flow unit, and alluvial plains. Stratigraphy from old to young is composed of Intrusion Tawangmangu unit, limestones unit, Lava Jobolarangan-1 unit, Lava Jobolarangan-2 unit, pyroclastic flow of Mount Jobolarangan unit, Lava Jobolarangan-3 unit, Lava Lawu-1 unit, Lava Ceto unit, unit of Lava Lawu-2 to lava Lawu-6, pyroclastic flow of Mount Lawu unit, Lava Mount Purung unit, Lava Lawu-7 unit, Lahar Lawu unit and alluvium unit. Geological structures exist in the research area is crater rim, relatively east-west and northwest-southeast normal fault, and southwest-northeast strike-slip fault.*

*The geochemical analysis show the type of Pablengan and Tasin hot springs is chloride type, type of Ngunut and Bayanan hot spring are dilute chloride, type of Nglerak, Mangli and Jenawi-2 hot spring are sulfate-chloride which has been diluted by meteoric water. The temperature reservoir in below of Pablengan hot spring is 150,1°C and Tasin is 173°C. Geothermal systems research area is relatively old system. Manifestation fluid originate from two different reservoir and geothermal fluid derived from meteoric water which has been mixed by andesitic water. Upflow zone located in the area of fumaroles Condrodimuko, while Tasin hot spring is outflow zone still in neared upflow zone, and other hot springs is outflow zone.*

**Keywords:** *Fluid geochemistry, isotope, origin of the fluid, fluid flow direction, Mt. Lawu, Geothermal.*