GENESA MATA AIR PANAS DAERAH BANTARKAWUNG, KABUPATEN BREBES

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Manifestasi panas bumi berupa mata air panas muncul di beberapa lokasi di sekitar Gunung Slamet, di antaranya di kawasan Guci, Baturraden, Paguyangan dan Bantarkawung dengan jarak masing-masing 7,5 km, 8 km, 25 km dan 33 km. Asal mula mata air panas di kawasan Guci dan Baturraden yang lebih dekat dipercaya berkaitan erat dengan aktivitas Gunung Slamet. Beberapa penelitian menyebutkan Paguyangan merupakan *outflow* dari Gunung Slamet, sedangkan kawasan Bantarkawung yang berjarak lebih jauh dan berada di luar zona distal dari Gunung Slamet belum diketahui dengan pasti. Penelitian ini bertujuan untuk: (1) mengetahui karakteristik fluida panas bumi, (2) mengetahui genesa mata air panas dan (3) mengetahui sistem panas bumi yang bekerja di daerah penelitian. Untuk itu, sampel air panas diambil dari mata air panas Cipanas, Karangpari dan Sungai Cilakar di Bantarkawung. Selain itu, sampel juga diambil dari kompleks mata air panas Baturraden, Guci dan Paguyangan sebagai perbandingan. Analisis kimia air dilakukan dengan metode *ion chromatograph*, *Inductively Coupled Plasma - Atomic Emission Spectroscopy* (ICP-AES), *mass spectrometry* dan titrasi. Jenis air di daerah penelitian berdasarkan diagram segitiga HCO_3-Cl-SO_4 dapat dibagi menjadi 4 jenis, air dari Bantarkawung masuk jenis *chloride-bicarbonate water* yang berasal dari air panas bumi (reservoir) yang bercampur dengan air permukaan, air dari Paguyangan masuk jenis *chloride water* yang berasal dari air panas bumi, air dari Baturraden masuk jenis *sulphate-chloride water* yang berasal dari uap panas bumi kaya H_2S yang bercampur dengan air panas bumi di kedalaman tertentu dan tercampur oleh air permukaan dan air dari Guci masuk jenis *bicarbonate water* yang berasal dari kondensat panas bumi kaya CO_2 yang bercampur dengan air permukaan. Komposisi isotop stabil ^{18}O dan ^{2}H menunjukkan bahwa fluida panas bumi berasal dari air meteorik. Hasil *plotting* pada diagram B-Cl-Li dan F-B-Cl menunjukkan adanya dua kelompok yang berbeda, sampel dari Baturraden, Paguyangan dan Sungai Cilakar (Bantarkawung) memiliki rasio Cl/B yang lebih tinggi (miskin Boron) sedangkan sampel dari Guci, Cipanas (Bantarkawung) dan Karangpari (Bantarkawung) memiliki rasio yang lebih rendah (kaya Boron). Namun grafik unsur jejak Rb dan Li vs Cl menunjukkan bahwa mata air panas Cipanas dan Karangpari masih masuk dalam garis *trend* sistem Baturraden, sehingga mata air panas Cipanas dan Karangpari diinterpretasi mendapat suplai dari kedua sistem tersebut. Tingginya konsentrasi B pada sistem Guci diinterpretasi merupakan hasil kontribusi sedimen kaya organik di reservoir, adanya lapisan sedimen tersebut dibuktikan dengan munculnya rembesan minyak di beberapa lokasi di sekitar Gunung Slamet meski formasi yang membawa material organik tersebut belum diketahui dengan pasti.

Kata kunci: geokimia, asal mula fluida, Bantarkawung, Gunung Slamet

ORIGIN OF HOT SPRINGS IN BANTARKAWUNG AREA, DISTRICT OF BREBES

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Geothermal manifestations were found in several places around Slamet Volcano, such as Guci, Baturraden, Paguyangan, and Bantarkawung with each distances are 7.5 km, 8 km, 25 km and 33 km. The origin of hot springs in Guci and Baturraden which are situated near the volcano are believed to be related with its activity. According to several researches, Paguyangan is the outflow manifestation of Slamet Volcano, while Bantarkawung which is located further from the volcano (out of the distal zone) is still uncertain. This research's aims are: (1) to understand the characteristic of geothermal fluids, (2) to understand the origin of the hot springs and (3) to determine the geothermal system which produces the manifestations. Thus, samples are taken from Cipanas, Karangpari and Cilakar River hot springs in Bantarkawung. Samples are also taken from hot springs complex in Baturraden, Guci and Paguyangan as comparison. Geochemistry analyses for water samples are conducted with ion chromatograph, ICP-AES (Inductively Coupled Plasma – Atomic Emission Spectroscopy), mass spectrometry and titration methods, as well as petrography for rock samples. There are four water types found in the research area, according to HCO_3-Cl-SO_4 diagram, waters from Bantarkawung are considered as chloride-bicarbonate water which is originated from geothermal (reservoir) water mixed with surface water, water from Paguyangan is considered as chloride water which is originated from geothermal water, waters from Baturraden are considered as sulfate-chloride water which is originated from geothermal vapor mixed with chloride water in the depth and mixed again with surface water, and waters from Guci are considered as bicarbonate water which is originated from geothermal condensate mixed with surface water. The stable isotopes ^{18}O and ^{2}H show that the source of geothermal fluid is meteoric water and manifestation waters are intensively mixed by meteoric water. B-Cl-Li and F-B-Cl diagram plotting show that there are two different trends: Baturraden, Paguyangan and Cilakar River (Bantarkawung) have higher Cl/B ratio (low-B), while Guci, Cipanas (Bantarkawung) and Karangpari (Bantarkawung) have lower Cl/B ratio (high-B). In the other hand, trace elements (Rb and Li) vs Cl graphs show Cipanas and Karangpari are still in the Baturraden-Paguyangan-Cilakar River trend line. Thus Cipanas and Karangpari hot springs are interpreted to be supplied by both (Guci and Baturraden) systems. High concentration of Boron Guci system is interpreted to be affected by organic-rich sedimentary horizon in reservoir. The existence of this organic-rich sedimentary horizon is proven by the appearance of several oil seepages around Slamet Volcano, even though the exact formation containing this horizon is still unknown.

Keywords: geochemistry, origin of fluids, Bantarkawung, Slamet Volcano