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Preliminary assessment of the geothermal system of the Tiris volcanic area, East Java, Indonesia.

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Indonesia, with 15 % of the world´s active volcanoes, hosts a total estimated geothermal potential of 27000 MW of which 1197 MWe in 2011 have been installed. Exploration of magmatic remote areas is therefore important. Our investigation area is located at the volcano Lamongan, Tiris East Java, Indonesia, which is part of the modern Sunda Arc Region, characterized by extensional regime. The average ground water temperature in the area ranges between 27 and 29 ˚C and the warm springs between 35 – 45 ˚C, evidencing a geothermal potential of the area. Numerous maars and cindered cones have been located and studied here, some of them with a NW – SE lineament similar to the Tiris fault (only observed in satellite images).

In this first exploration stage we characterized the geochemistry of the springs and investigated the petrology of the rocks. They were analyzed in terms of mineral composition (optical microscopy and electron microprobe) and major element composition (X-ray fluorescence). The samples have a typical basaltic – basaltic andesite composition, with abundant plagioclase with An_{65} up to An_{90}, as well as olivine and pyroxene. The plagioclase crystals are several mm large, twinned and show no hydrothermal alteration.

The fluid chemistry was determined in term of cation and anion concentration with Inductively Coupled Plasma Mass Spectrometry. The chemistry of geothermal waters provides specific information about the deep of the fluids in geothermal system and the discharge location.

The concentrations of Na^+, Ca^{2+}, Li^+, B^{3+} and Cl^- suggest that the water of the Lamongan area derive from sea water intrusions. The high permeable pyroclastites, overlain by lower permeable basalt – andesitic basalt, observed in the field, may have channeled the sea water from the coast to the Tiris area. A structural lineament, NW – SE, may control the water intrusion, as the lineament of the springs confirms. The high HCO_3^- concentration in the fluid samples, as no carbonate rocks are known in the area, must derive from another source (magma chamber?). The occurrence of pyroclastites overlain by andesite suggests the presence of a concealed layer. This could be responsible for capturing SO_4^{2-} accounting to the HCO_3^- excess of the springs, located in the outflow zone of the system.

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