

GEOCHEMICAL SURVEY OF HOT AND COLD WATERS AROUND THE MISTI VOLCANO

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ABSTRACT

The summit of Misti volcano (5822 m.s.n.m.) is located at 17 km from the downtown of Arequipa (~1000000 inhabitants), the second largest and important city of Peru. The volcano piedmont extends to the vicinity of the city and includes the most recent volcanic products of its activity (Sub-plinian eruption ~340 BC - 200 AD). The present-day volcanic activity is limited to fumarolic emissions at the summit.

Hazards related to this volcano are tephra falls, pyroclastic flows and surges that would reach 13 km far from the crater and according to the crater geometry it is probable that the direction of future pyroclastic flows will be to the south reaching the suburbs of the city. Consequently, Misti appears as one of the highest priority in volcano monitoring in southern Peru.

Since 1998, after a geochemical survey on some 15 springs around Misti, we selected and started monitoring the "Charcani V", hot spring located 6 km northwest from the crater, between 3250 and 3550m altitude. This work allowed us to establish a baseline that depicts short-term (weekly to monthly) variations in composition and physical parameters.

Analyses of the waters collected around the volcano displays evident geochemical trends that are interpreted as the result of mixing processes between fresh meteoric waters and magmatic fluids, sometimes interacting with a deep chloride reservoir. In fact, we can distinguish three types of waters:

- Earth-alkaline chloride-sulfate
- Alkaline chloride-sulfate
- Alkaline bicarbonate-sulfate

According to the results obtained during the period of 8 year-old monitoring (1998 to 2005), it has been observed that the chloride (Cl⁻), Sulphate (SO₄²⁻) ions and the parameters of temperature and pH have suffered considerable pulsations in the period comprising the year 2001. Also, in the part summit part of the Misti volcano we noticed important variations: 1) an increase of the fumarolic intensity of the crater active visible from Arequipa city since beginnings of the month of August of the 2001, 2) an increase of the temperature in the crater dome that varied from a maximum of 221°C (December 1, 1997) until a maximum of 430°C (September 11, 2001). In coincidence with the physical and chemical variations observed in mid 2001 a strong (8.2 Mw) earthquake occurred in the southern Peru on June 23. The reported hypocentral location was 16°14' lat. S, 73°31' long W and 28 Km of depth.

On active volcanoes, sulfate and chlorine elements essentially come from the interaction of water with acid gas species (HCl, SO₂/H₂S). Therefore, the observed geochemical changes could be explained by a mixing between the hydrothermal water with surrounding shallow cold waters with lower sulfate and chlorine concentrations. This mixing process could be the

consequence cause of a permeability increase inside the volcanic edifice due to the intense shake induced by the earthquake of June 23rd, 2001.