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Isotopic, chemical and dissolved gas constraints on spring water from Popocatepetl volcano (Mexico): evidence of gas–water interaction between magmatic component and shallow fluids

S. Inguaggiato[a,*], A.L. Martin-Del Pozzo[b], A. Aguayo[b], G. Capasso[a], R. Favara[a]

[a]*Istituto Nazionale di Geofisica e Vulcanologia Sezione di Palermo, via Ugo La Malfa, 153, Palermo, 90146, Italy*
[b]*Instituto de Geofisica UNAM, Ciudad Universitaria, Mexico DF, 04510 Mexico*

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Abstract

Geochemical research was carried out on cold and hot springs at Popocatepetl (Popo) volcano (Mexico) in 1999 to identify a possible relationship with magmatic activity. The chemical and isotopic composition of the fluids is compatible with strong gas–water interaction between deep and shallow fluids. In fact, the isotopic composition of He and dissolved carbon species is consistent with a magmatic origin.

The presence of a geothermal system having a temperature of 80–100° C was estimated on the basis of liquid geothermometers. A large amount of dissolved CO_2 in the springs was also detected and associated with high CO_2 degassing.

Keywords: popocatepetl volcano; helium isotope composition; carbon isotope composition; dissolved gases; gas–water interaction

1. Introduction

Popocatepetl (Popo) is a large andesitic stratovolcano (5452 m) near Mexico City, which has been erupting since December 1994. The fumarolic activity increased in the early 1990s and culminated in ash eruptions at the end of 1994 and in early 1995. Since 1996, a consecutive series of crater domes have been formed and destroyed explosively. During the previous eruptive activity (1918–1925), a small dome also grew on the crater floor.

Popo is potentially dangerous because of its explosive eruptive history and because millions of people live within 60 km of the volcano. A geophysical and geochemical monitoring network is maintained by UNAM-CENAPRED in order to evaluate changes in the eruptive activity.

Popo forms the southern part of the Sierra Nevada complex which includes the older volcano, Iztaccihuatl (Izta). The present-day Popo cone is also built on an older volcano that was destroyed in a Bezymmianny-type event (Robin and Boudal, 1987). To the south of

* Corresponding author. Fax: +39 91 6809449.
E-mail address: s.inguaggiato@pa.ingv.it (S. Inguaggiato).

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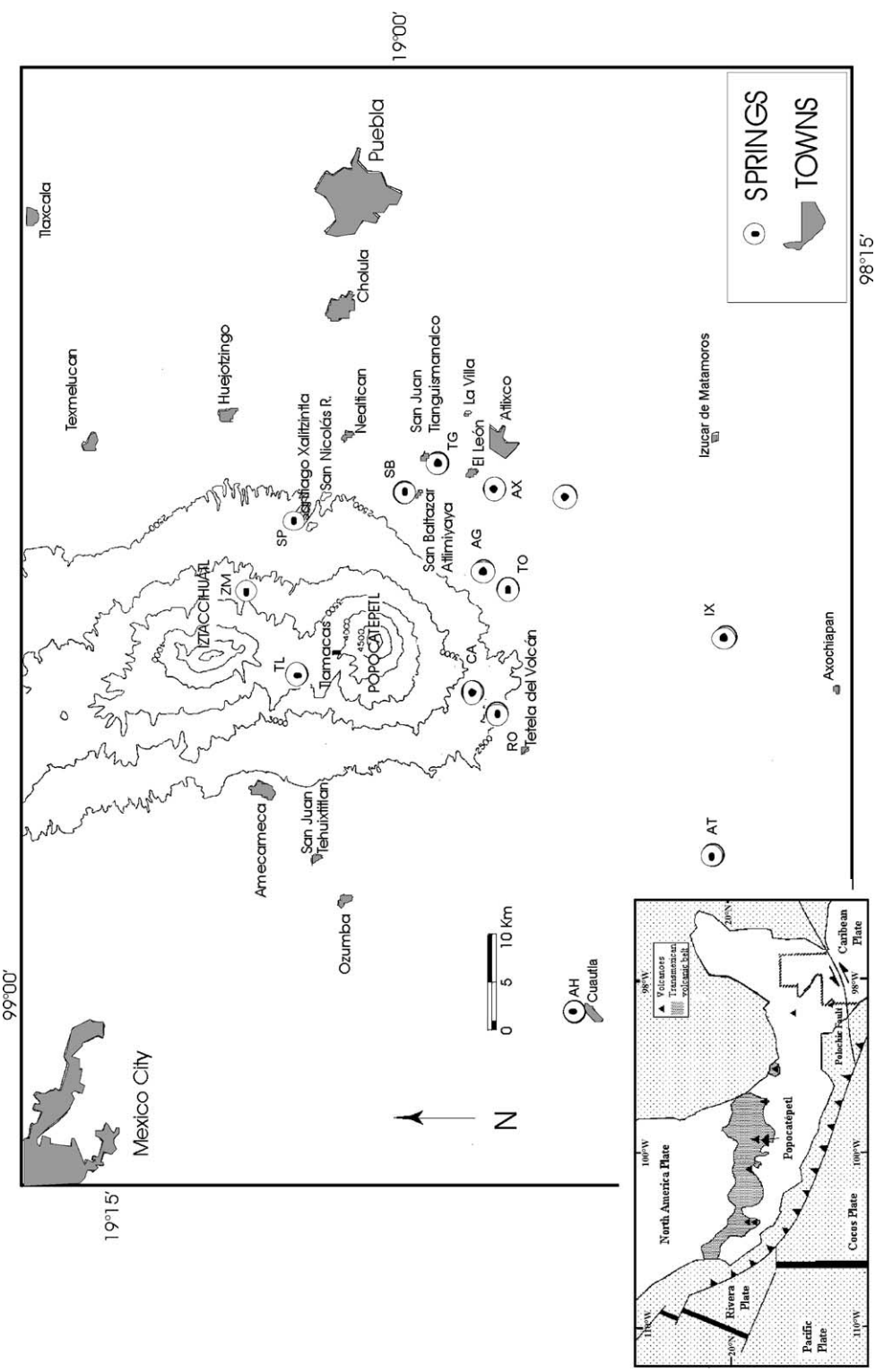

Fig. 1. Location map of sampled springs.