Latin America: Isotopes to tap Earth's thermal energy

by Roberto Gonfiantini

One of the first activities organized within the framework of a new Co-ordinated Research Programme on the Application of Isotope and Geochemical Techniques to Geothermal Exploration — which the Agency is launching in Latin America with the financial support of the Government of Italy — took place in Morelia, Mexico recently.*

The programme's interest in Latin America is tied to the fact that many countries in the region have excellent prospects to utilize geothermal resources for electricity production. The leading country in the region is Mexico, which is among the world's major producers of geothermal electricity.** El Salvador also is currently producing geothermal electricity, and other plants are foreseen for future installation in Costa Rica, Guatemala, and Nicaragua.

Italy's support for this programme derives from the fact that it was the first to produce electricity from a geothermal field and possesses strong experience in geothermal research and exploitation technology.

Geochemical and isotope investigations are among the cheapest and most useful studies to carry out in an initial stage of geothermal exploration. Much information can be derived on natural manifestations (such as hot springs, fumaroles, and mophettes) present in a new, unexploited geothermal field. These may or may not lead to other more expensive investigations (for example, geophysical ones) and, finally, to exploratory drillings. Even when a geothermal field already is in exploitation, isotopes constitute an important tool to investigate, follow, and predict the field's behaviour, with results that may have a bearing on exploitation strategy.

Proposals from nine nations expected

In Morelia, many scientific investigators who will be in charge of or will co-operate in various research projects included in IAEA's programme were present. Research project proposals from nine countries are expected for submission to IAEA in the near future. These countries are Argentina, Bolivia, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Peru, and Venezuela.

At the seminar, invited lectures were delivered on geochemical and isotopic investigations carried out in many geothermal fields of the world, such as Campi Flegrei, Larderello, and Monte Amiata (all in Italy); Broadlands and Wairakei (New Zealand); the Geysers, Lassen Park, Yellowstone (USA); Cerro Prieto and Los Azufres (Mexico); and Manikaran (India).

Several general lectures, more theoretical in character, addressed isotope variations in water, water-rock interaction processes, composition of geothermal fluids, and geochemical equilibria and kinetics (including gas reactions and isotope fractionations).

Also discussed were problems related to sample collections and representativity. Sampling of geothermal fluids, in fact, is not generally straightforward, due to complications from high temperature and the large fraction of gaseous components and steam. Discussions were devoted to so-called geothermometers, that is, to those isotopic and chemical temperature-dependent equilibria that can be used to evaluate temperature of geothermal fields at depth.

Concerning the problem of reinjection to evacuate polluting waters delivered by geothermal wells, it was pointed out that isotopes help to identify patterns and distribution of reinjected water in geothermal fields.

In addition to these lectures, presentations were made by participants, with those from Mexico reporting on a number of geochemical and isotopic investigations carried out or in progress in their geothermal fields. Other participants mainly discussed the current status of geothermal projects in their countries.

The seminar also featured an excursion to the geothermal field of Los Azufres, about 100 kilometers

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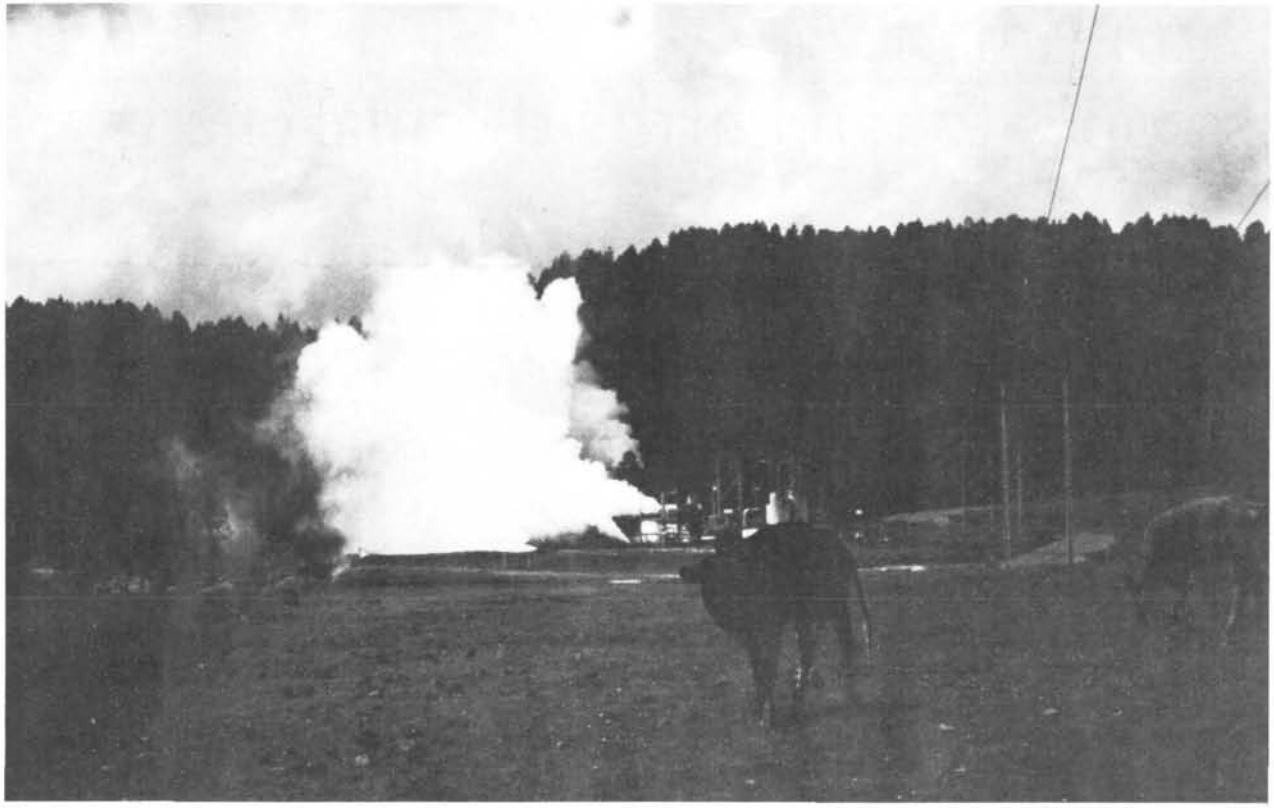
Mr Gonfiantini is a staff member in the Isotope Hydrology Section of the Agency's Division of Research and Laboratories.

* The seminar was officially entitled "Seminar for Latin American Countries on the Use of Isotope and Geochemical Techniques in Geothermal Resources Exploration" and was held 11–22 June 1984.

** Other leading producers are the United States, Philippines, Italy, New Zealand, and Japan. See, for example, "Isotopes in Geothermal Energy Exploration", *IAEA Bulletin*, Vol.25, No.2, June 1983.



The geothermal field of Los Azufres near Morelia, Mexico is one of many world-wide where isotopic studies have been used to help engineers explore Earth's thermal energy potential. In the near future, IAEA expects to receive research proposals from nine Latin American countries interested in applications of isotopes for geothermal exploration.

east of Morelia, where a demonstration sampling was conducted.

On the whole, the seminar aroused a high level of interest, based on the number and quality of questions from participants, an informal and friendly atmosphere, and the hospitality of the hosts, the Comisión Federal de Electricidad.

Many seminar participants previously had attended post-graduate courses annually organized in Pisa, Italy at the Istituto Internazionale per le Ricerche Geotermiche, which belongs to the National Research Council. As part of the course, which is co-sponsored by the Italian Government and UNESCO, an IAEA staff member is invited each year to lecture on the use of isotopes in hydrology, including geothermic applications, and to illustrate how Member States can receive help in this field through IAEA activities such as the Technical Co-operation programme.