

## Concurrent island arc and intraplate volcanism, Eshtehard-Karaj area, NW Iran

M.R. GHORBANI AND M. GHADERI

Department of Geology, Tarbiat Modares University, Tehran  
14115-175, Iran mghaderi@modares.ac.ir

This paper discusses the geochemical characteristics of the Paleogene volcanic rocks from Eshtehard-Karaj area, Iran. A representative set of 15 volcanic rocks from the study area were analyzed for their major elements, Nb, Zr, Y, Sr, Rb, Ba, Pb, U (XRF lab., UNSW, Sydney), REE, Th, Hf, and Ta (NAA, Becquerel lab., Sydney) for the first time. The study area is the northernmost part of a major tectonomagmatic unit, Urumieh-Dokhtar magmatic assemblage, interpreted to be the product of an island arc magmatism during the subduction of the Neo-Tethyan oceanic realm in late Mesozoic and Cenozoic time (Alavi, 1996).

On silica-Ti diagram, data points from the volcanic rocks are clustered in two distinct groups; one with lower Ti content than the other. Thereafter, they are called LT and HT series. The latter mostly occurs in the eastern part of the study area (i.e., Karaj). Detailed investigation of trace element geochemistry of the volcanic rocks shows fundamental differences between LT and HT series. Primordial mantle-normalized trace element patterns of the LT series rocks show highly distinctive "spiked" trace element patterns at Ba, K, and Sr, negative Nb anomalies, and a mean trace element concentration of around 10 times primordial mantle. Samples from the HT series, on the other hand, show rather smooth patterns with higher trace element abundances. Compared with the LT series, samples from the HT series are enriched in the whole range of trace elements (esp., Ta and Nb); only K and Sr remain at the same level. Volcanic rocks from the LT and HT series show remarkable geochemical similarities with the calc-alkaline island arc volcanic rocks and midalkaline oceanic island arc volcanics, respectively.

This study supports the earlier finding that an island arc-type magma was involved in Eocene-Oligocene magmatism in the study area. Contribution of this study is, however, the introduction for the first time of a set of volcanic rocks with the geochemical characteristics of an intraplate volcanism (i.e., OIB). These oceanic island basalt-type volcanics are derived from an enriched mantle source, in contrast with the depleted asthenospheric mantle component involved in generation of the island arc-type volcanics.

### References

Alavi, M., (1996), *J. Geodynamics*, **21**, 1, 1-33.

## Particulate atmospheric emissions from a power plant combusting a coal+tire mixture

R. GIERÉ<sup>1</sup>, K. L. SMITH<sup>2</sup> AND M. BLACKFORD<sup>2</sup>

<sup>1</sup> Earth and Atmospheric Sciences, Purdue University, West Lafayette, IN 47907-2051, USA (giere@purdue.edu)

<sup>2</sup> Materials Division, ANSTO, Menai, NSW 2234, Australia

Forty percent of all automotive tires discarded in the U.S are combusted for energy recovery. This method of tire disposal turns a major waste stream into an alternate fuel and could lead to significant savings. However, it also increases the concentration of some chemical elements in the combustion products (e.g., fly ash) as well as in the particulate matter emitted into the atmosphere.

The Purdue University power plant conducted an experiment with two different sets of fuel combusted at the same conditions ( $\approx 1500$  °C): pure coal and a mixture of 95 wt% coal plus 5 wt% tire-derived fuel (TDF). A detailed chemical comparison was made of both types of fuel, the combustion products, and the atmospheric emissions. Compared to pure coal (sub-bituminous coal from Southern Indiana), the coal+TDF mixture is considerably richer in Zn ( $183 \pm 42$  vs.  $36 \pm 16$  ppm), and also has a higher S content ( $2.0 \pm 0.4$  vs.  $1.5 \pm 0.2$  wt%). The increase in Zn is due to the high Zn content of the scrap tire chips ( $10936 \pm 849$  ppm). Most of the other 56 elements studied had similar concentrations in both fuel types. Compared to combustion of pure coal, the use of coal+TDF as fuel leads to higher emissions of various compounds, most notably Zn (increase from 55 g/h to almost 2.4 kg/h).

Particulate matter was collected on filter paper that was inserted into the top part of the smokestack. The collected particles thus represent the fly ash fraction that has not been trapped by any of the air pollution control devices and thus, would have escaped into the atmosphere. Characterization of these fugitive particles by scanning and transmission electron microscopy revealed the presence of amorphous material (primarily aluminum-silicate glass spheres) and a variety of crystalline, mostly euhedral S-rich phases (inferred to be sulfates). The latter include sulfates of Ca, Zn, Pb, Fe-Zn, K-Fe, and K-Fe-Zn, and are, in many cases, enclosed by or attached to the glass spheres. Other crystalline phases found so far are lime and mullite. The types of aerosol particles generated during combustion of pure coal does not seem to differ from those produced during combustion of the coal+TDF mixture. Judging from the substantially higher Zn emissions in the second case, however, it is inferred that the Zn-containing sulfate crystals are more abundant there.

The experiment demonstrates that combustion of coal+TDF leads to a considerable increase in the Zn concentration not only in the trapped fly ash but also in the emitted aerosol particles, where most of the Zn occurs as a major constituent of crystalline sulfates.