Comparative studies on the Tectonics and Volcanism of Circum-Pacific Arcs

PART B

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FOREWORD (Part B)

The features of the Mexican Arc (Trans-Mexican Volcanic Belt, TMVB) are quite unusual (Delgado, 1994). We now have a better picture of the morphology of the subducting plate beneath southern Mexico (Pardo and Suárez, 1994), but several questions remain to be solved e.g., the anomalous chemistry and distribution of volcanic rocks (lamprophyres on the volcanic front in western TMVB) along the arc (e.g. Lange and Carmichael, 1992).

The suggestion of an ongoing continental rifting process in western Mexico (Luhr *et al.*, 1985) is still a matter of discussion (Ferrari *et al.*, 1994a, 1994b; Maillol and Bandy, 1994) and has been extended farther to the east (Verma, in preparation). A break-apart process is very difficult to demonstrate and one way of getting a better insight into the problem is a comparison of the Mexican geological features with the features of others arcs, such as the Japanese Arc.

The opening of the Japan Sea in Miocene times (Yamaji, 1994a) provides an example of the kind of processes which occurred during this event. This special issue on *Comparative studies on the Tectonics and Volcanism of Circumpacific Arcs* (Part A and B) aims to serve as a reference which could be used for a better understanding of the geological setting of the Mexican and Japanese arcs.

The tectonic scenario of the Japanese Arc has been illustrated by Takahashi (1994) and Yamaji (1994b). In this second part, Tsuchiya's paper complements the Miocene portrait, showing the magmatic patterns in close relationship with the tectonic environment. Middle Miocene extensional tectonics coincide with magmatism related to dyke swarms trending NNE-SSW to NE-SW. The chemistry of the rocks (major and trace elements) are of back-arc basin signature. The extensional tectonics and associated fissural extrusive and intrusive magmatism remind of the tectonic features of the Michoacán-Guanajuato and Chichinautzin volcanic fields, where monogenetic volcanism is closely related to the traces of fissures (faults and fractures). However, the chemistry of both volcanic fields is different from the basaltic rocks of NE Japan.

The paper by Urrutia-Fucugauchi deals with the paleomagnetic signature of the rocks of Iztaccíhuatl Volcano. The polarity data suggest assigning the suite to the Pacific Brunhes low non-dipole region. The upper suite of this volcano is dated between 580,000 and 76,000 years B. P. and represents a good marker for correlative work.

The paper by Besch and co-workers represents a contribution to the knowledge of the genesis of magmas in the TMVB, particularly at the eastern edge of the belt. The role of the mantle and/or crust in the generation of magmas is derived from Sr and Nd isotopes. A complex model arises from this analysis, invoking mantle heterogeneities and assimilation of crustal material. This approach emphasizes the role of the underlying plate during the magma generation process.

The paper by Fujiwara and co-workers addresses the tectonic problem of arc-trench systems in Hokkaido, using paleomagnetism and sedimentary petrology. Three provinces are recognized, showing influence from two different sedimentary sources including an intermediary zone. The rotation of the Kurile Islands after Late Eocene evidences the high activity of the Japanese and Kurile arcs around the time when calderas were waning in northwest Mexico.

There are three papers on monogenetic volcanism in the Michoacán-Guanajuato Volcanic Field. Monogenetic volcanism is well represented in the extensional tectonic environment of Mexico, but has not been much documented for the Japanese islands except in the Pleistocene. Features like those described in Tsuchiya's paper could be related to the roots of eroded monogenetic volcanic fields, as has been suggested for some volcanic regions in Japan (Delgado, 1989).

Ken Kurokawa and collaborators identify the stresses at MGVF and study the distribution of volcanoes using a fractal approach. They find s1 in a vertical position and s2 trending E-W in the northern part of the field and NE-SW in the southern part. These stress patterns are related to the kinematics of plates as a result of rollback of the Middle America trench axis. Fractality and fractal parameters are explained in terms of viscous fingering or percolation in porous media as a function of the crustal tensile stress. This provides an insight on the "plumbing" system at monogenetic volcanic fields. It would be interesting to apply this approach to the NE Japan basaltic dyke swarms mentioned by Tsuchiya (this volume).

The paper by Hooper proposes a finite element model to correlate the cone exposure time with the decrease of cone height, the cone height/width ratio, and the slope. The morphometric ages are calibrated by radiometric dating. The results, both at MGVF and at the Colima monogenetic field, suggest the effects of climate change. Effects of climate change had not been evaluated before, even though several attempts had been made to morphologically date volcanoes.

Extensional tectonics at MGVF is also evidenced by trenchward volcanic front migration, as in the paper by Delgado *et al*. The volcanic front at MGVF has changed its position very fast. The whole field has moved trenchward, as the volcanic front advanced by 90 km during the last 0.78 Ma, the time of the last magnetic polarity change.

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