Comunicaciones N° 42 - 1991: 39 - 43
Departamento de Geología, Universidad de Chile, Santiago

GEOLOGY, SANDSTONE PETROFACIES AND GEOCHEMISTRY OF THE GUERRERO TERRANE, WESTERN MEXICO

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The Guerrero terrane (Campa and Coney, 1983) makes up most of the western part of Mexico and is the largest suspect terrane of the North America Cordillera. The terrane is mostly composed of Upper Jurassic to Middle Cretaceous volcanic-sedimentary rocks of arc affinity and has been subdivided into three subterranes; Teloloapan, Huetamo and Zihuatanejo (Campa and Coney, 1983) (Fig. 1).

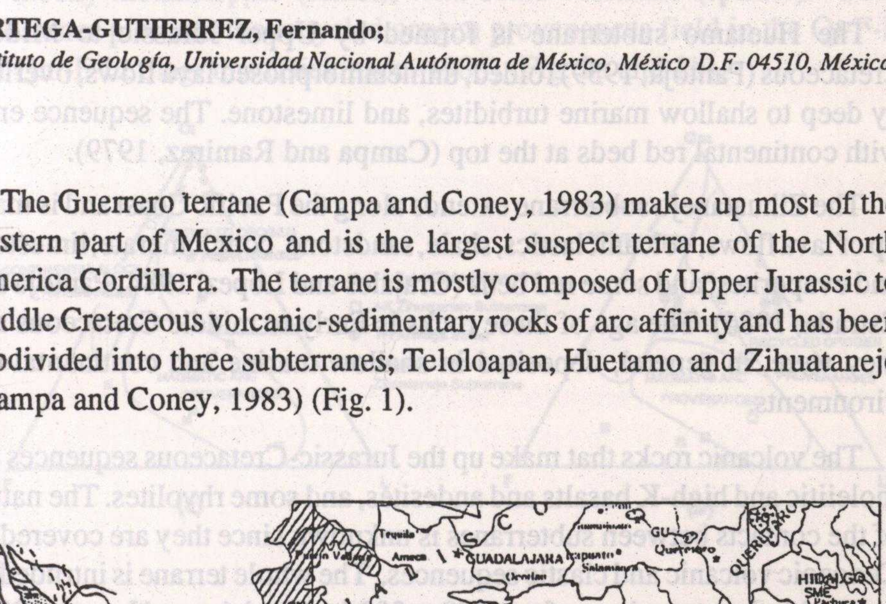

Figure 1: Location of the Guerrero terrane and subterranes (after Campa and Coney, 1987).

The Teloloapan subterrane is exposed in the easternmost sector of the Guerrero terrane and lies west of the Mixteco terrane (Fig. 1). This subterrane is made up of severely deformed and low-grade metamorphosed submarine lavas and volcaniclastics, graywackes, sandstone, carbonaceous shales, chert and limestone. Structurally, this subterrane is characterized by a complex thrust fault system that verges eastward, and overrides Cretaceous shelf carbonates of the Mixteco terrane (de Cserna, 1978; Campa and Ramirez, 1979).

The Huetamo subterrane is formed by Upper Jurassic to Middle Cretaceous (Pantoja, 1959) folded, unmetamorphosed lava flows, overlain by deep to shallow marine turbidites, and limestone. The sequence ends with continental red beds at the top (Campa and Ramirez, 1979).

The Zihuatanejo subterrane extends along the Pacific Coast and is made up of lava flows, volcaniclastics, shale, sandstone, conglomerate, limestone and evaporites, and some red beds (Grajales and Lopez, 1984; Pantoja and Estrada, 1986). The age of these rocks is Early to middle Cretaceous and they were, in general, deposited in shallow marine and continental environments.

The volcanic rocks that make up the Jurassic-Cretaceous sequences are tholeiitic and high-K basalts and andesites, and some rhyolites. The nature of the contacts between subterranes is unknown since they are covered by Cenozoic volcanic and clastic sequences. The whole terrane is intruded by granitoids that range in age from 158 to 30 Ma. (Grajales and Lopez, 1983). Scarce ultramafic intrusives crop out in the Teloloapan and Zihuatanejo subterranes (Delgado-Argote et al., 1989).

Older metamorphic rocks of Late Triassic age (Arteaga Schist) (Campa et al., 1982) underlie at least part of the Zihuatanejo and Huetamo subterranes (Fig. 1). This unit is made up of submarine basaltic lava flows (pillow lavas), chert, and sandstone interbedded with shale, all deformed and metamorphosed to greenschist facies. The lithologic associations of the Arteaga Schist suggest that such rocks were deposited in a deep marine environment. This metamorphic unit is highly sheared, and structures related to two phases of deformation have been found.

The contact between the Jurassic-Cretaceous sequences and the older Arteaga Schist is tectonized and faulted in the few places were it has been observed. However, the different deformation styles of both sequences and the fact that there are fragments of the Triassic rocks in conglomerates of the Jurassic-Cretaceous rocks suggest that the contact was initially an unconformity.

Petrographic analysis of sandstones and conglomerate clasts from both Triassic and Jurassic-Cretaceous sequences show different compositions. The Triassic sandstones within the Arteaga Schist are quartz-rich (quartzolithic suite) (Q=88, F=3, L=9). Monocrystalline quartz is more abundant than polycrystalline quartz (mostly chert), and the lithic grains are mostly metamorphic (schist), with some volcanics (spillite). Such sandstones plot into the recycled orogen provenances field in the Qt-F-L and Qm-F-Lt diagrams (Dickinson, 1985) (Fig. 2a and 2b).

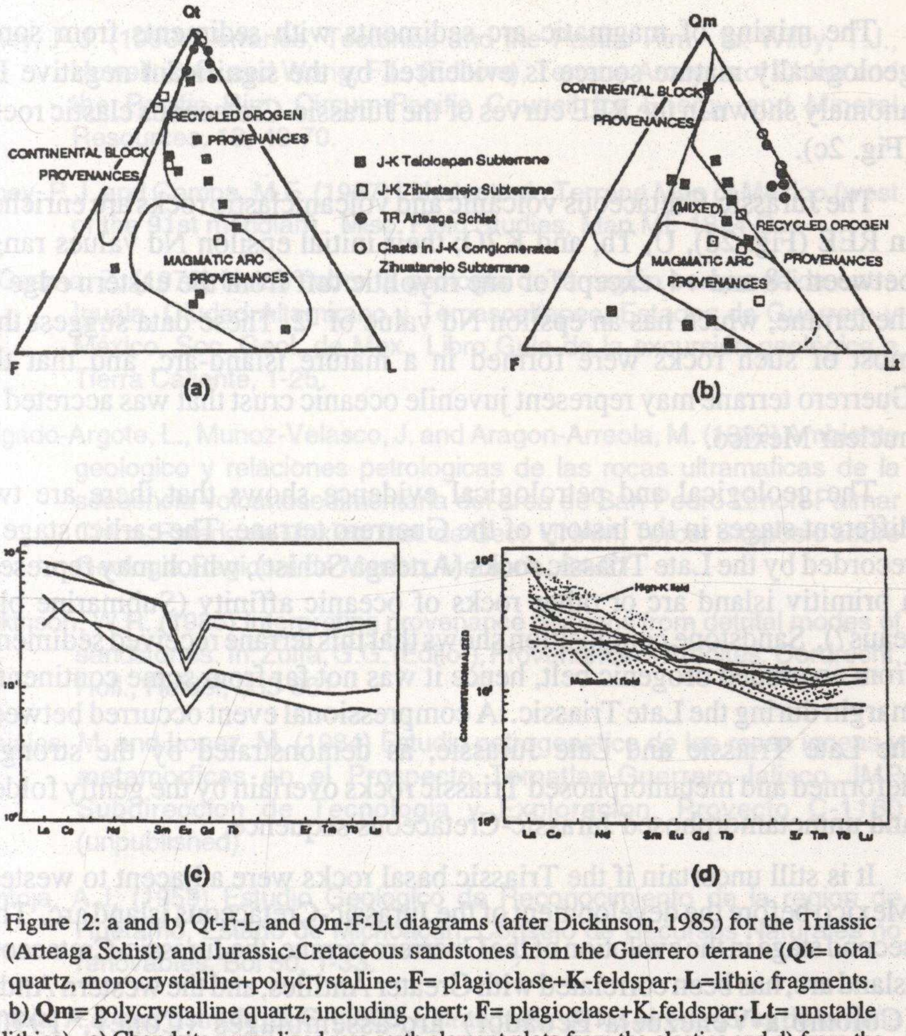

Figure 2: a and b) Qt-F-L and Qm-F-Lt diagrams (after Dickinson, 1985) for the Triassic (Arteaga Schist) and Jurassic-Cretaceous sandstones from the Guerrero terrane (Qt= total quartz, monocrystalline+polycrystalline; F= plagioclase+K-feldspar; L=lithic fragments. b) Qm= polycrystalline quartz, including chert; F= plagioclase+K-feldspar; Lt= unstable lithics). c) Chondrite normalized rare earth element plots from the clastics and d) from the volcanic-volcaniclastic rocks from the Jurassic-Cretaceous sequences of the Guerrero terrane.

In contrast, the Jurassic-Cretaceous sandstones of the Zihuatanejo subterrane show a wide range in composition from quartzofeldspathic (Q=79, F=19, L=2) to lithovolcanic (Q=34, F=27, L=39). Lithic grains are mostly volcanic, with some schist and chert. They plot mostly into the recycled orogen and magmatic arc fields of the Qt-F-L and Qm-F-Lt diagrams. This wide range in composition is probably due to mixing of volcanic material with sediments derived from the Triassic rocks. The conglomerates are composed of volcanics, quartzolithic sandstone (Fig. 2a and 2b), vein quartz, and scarce schist and granitic clasts. The same broad compositional pattern is shown by sandstones from the Teloloapan subterrane (Fig. 2a and 2b) (Delgado et al., 1989).

The mixing of magmatic arc sediments with sediments from some geologically mature source is evidenced by the significant negative Eu anomaly shown in the REE curves of the Jurassic-Cretaceous clastic rocks (Fig. 2c).

The Jurassic-Cretaceous volcanic and volcaniclastic rocks are enriched in REE (Fig. 2d), U, Th, and K2O; their initial epsilon Nd values range between +8 and +4, except for one rhyolitic tuff from the eastern edge of the terrane, which has an epsilon Nd value of -2. These data suggest that most of such rocks were formed in a mature island-arc, and that the Guerrero terrane may represent juvenile oceanic crust that was accreted to nuclear Mexico.

The geological and petrological evidence shows that there are two different stages in the history of the Guerrero terrane. The earlier stage is recorded by the Late Triassic rocks (Arteaga Schist), which may represent a primitiv island arc or other rocks of oceanic affinity (Submarine plateaus?). Sandstone composition shows that this terrane received sediments from an eroded orogenic belt, hence it was not far from some continental margin during the Late Triassic. A compressional event occurred between the Late Triassic and Late Jurassic, as demonstrated by the strongly deformed and metamorphosed Triassic rocks overlain by the gently folded and unmetamorphosed Jurassic-Cretaceous sequence.

It is still uncertain if the Triassic basal rocks were adjacent to western Mexico before the development of the Jurassic-Cretaceous island arc. This second stage in the evolution of the Guerrero terrane, the Jurassic-Cretaceous island arc, has been correlated with Greater Antilles, and the western Andes (Colombia-Venezuela-Ecuador) arc-assemblages (Coney, 1990). Geochemical similarities between such terranes support this idea.

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