

The Matalaque Formation of southern Peru: New stratigraphic and geochemical data

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Introduction

The Matalaque Formation crops out in the Western Cordillera of Southern Peru between 16°20' y 17°45' South Latitud. It was described initially by Marocco and del Pino (1966) in the Ichuña sheet (department of Moquegua), extending southward to Carumas-Omate sector where it was described by Garcia (1978); in this area Vicente (1981) describes it as a lateral equivalent of the Murco Formation

In the Pachia and Palca region, Wilson and Garcia (1962) define a similar sequence (volcano-sedimentary) named Chulluncane Formation. Later Monge and Cervantes (2000), redefine this litho-stratigraphic sequence establishing is the same unit recognized in Ichuña (Matalaque). The objective of this paper is to contribute with new litho-stratigraph of the associated sedimentary basin that was deposited during the Aptiano-Albiano.

Geologic Setting

The Matalaque Formation volcanic sequences crops out along a Southeastern-Northwest trending discontinuous belt between Ichuña (Moquegua) and Palca (Tacna) localities that correlate to the Northwest with the Murco Formation (Arequipa basin) and in the altiplano with the Viluyo Formation.

The following two measured sections are described in: 1) Omate and 2) Palca.

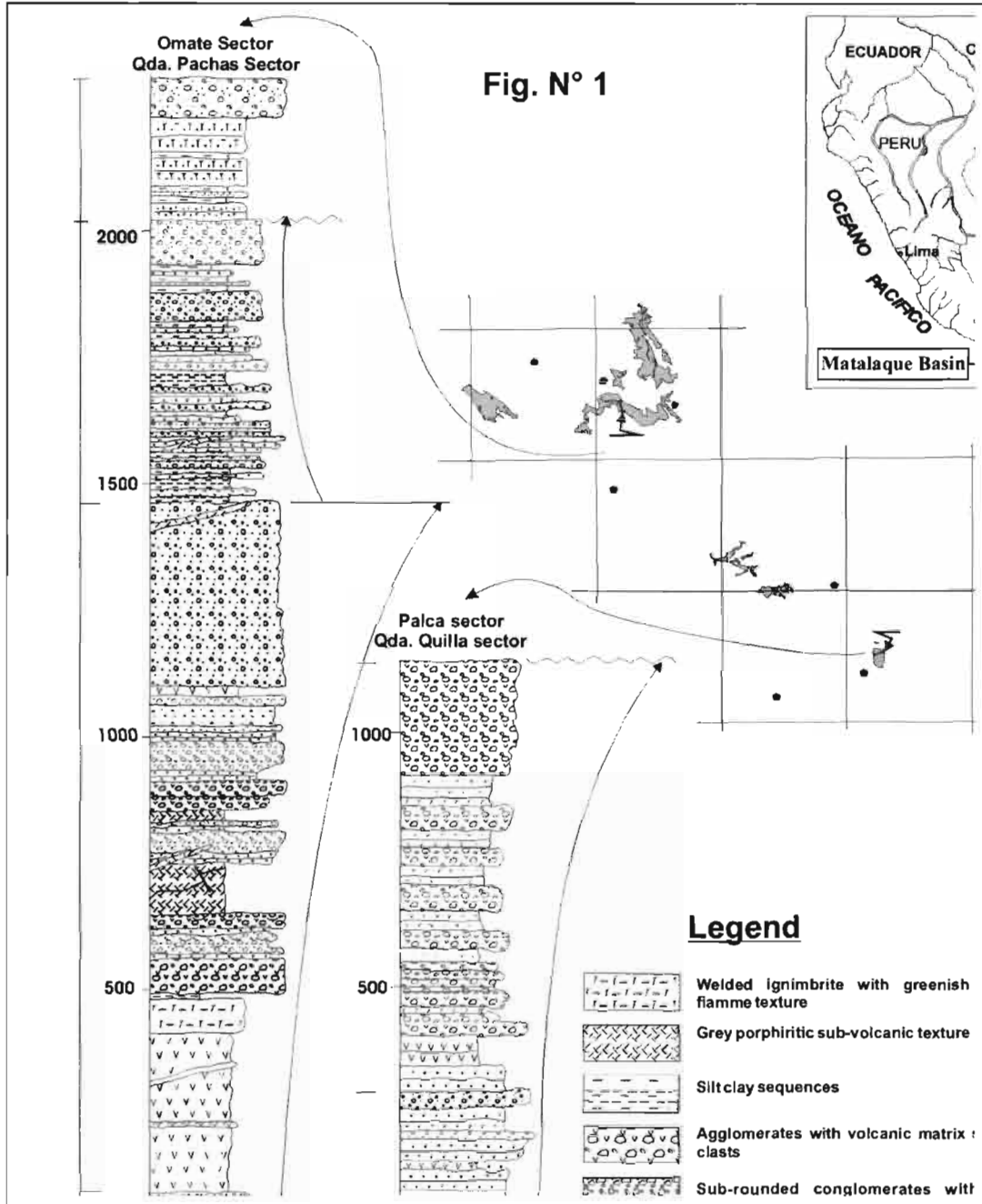
Omate Sector

Measured Section: In the Pachas stream it have been described three members, from the base to the top **1) Lower Member** constituted by coarse to medium grained sandstones interbedded with limestones and conglomerates, making a coarsening and thickening upwards sequence. The conglomerates contain clasts of andesitic volcanic rocks, of variable diameter of up to 2 cm included in a tuffaceous matrix. **2) Intermediate Member** predominantly volcanic, conformed by a sequence of andesitic and dacitic flows with intercalations of agglomerates with sub-rounded clasts of sands, limestones and volcanic rocks of variable diameter between 2 and 80 cm. Epidotization and moderate chloritizations observed in the matrix as well as in the volcanic clasts **3) superior Member**, consists of intercalation of sandstones arenaceous and fossiliferous silty claystones. Thickness of the measured section: $\pm 2,050$ m. Stratigraphies Relations: Overlaies in light angular discordance to the sandstone lithofacies of the Hualhuani Formation (Yura Group) and underlies in erosional discordance to the Huaracane Formation (Toquepala Group) of 75 ± 2 Ma Martínez and Cervantes, (2003). Fossil evidences: In the upper member Quispesivana and Zapata (2000) report, leaves and stems of the Otozamites sp. Taxon, allowing to assign an age between the Aptian - Alban.

Palca Sector

- Measured Section: In the Qilla Stream, located to the East of Tacna, two members have been differentiated: **1) Lower Member** predominantly conformed by medium grained feldespatic sands interbedded with

conglomerates (clasts up to 2 cm) and some levels of lavic flows taps of andesitic composition. **2) Upperr Member** corresponds to a volcano-sedimentary sequence. Towards a the base an intercalation of coarse granines sandstones and andesitic lavas followed by a predominance of agglomerates over flows is observed. Unlike the



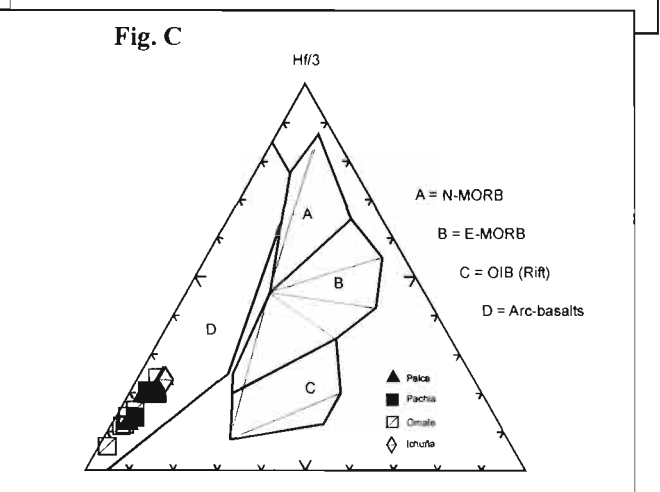
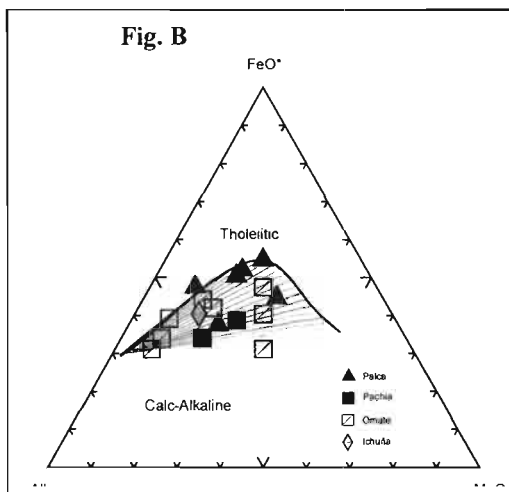
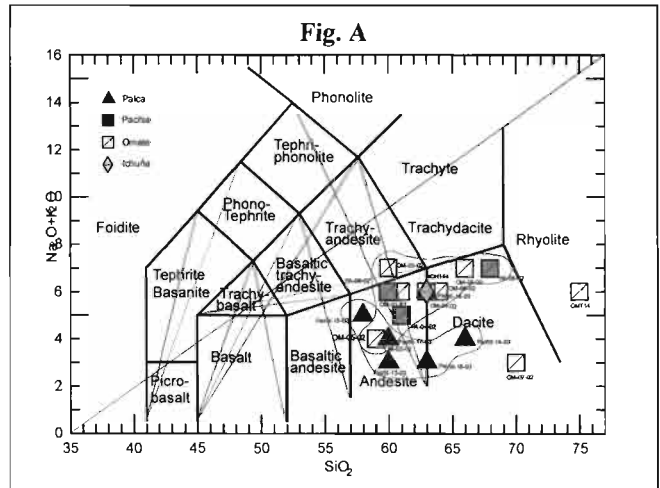
sector of Omate the agglomerate clasts range from 5 to 20 cm of diameter. The upper member found in Omate was not recognized.

- Thickness of the measured section: ± 1150 ms.
- Stratigraphic Limits: Overlies in slight angular discordance to the Hualhuani Formation and underlies uncoformable to the Tacaza Group volcanites (Huilaollo and Tarata formations).
- In this sector the middle part of the upper member is intruded by Yarabamba Super Unit granodiorites, of 70.1 ± 0.90 Ma. Martínez and Cervantes, (2003).

Volcanism and Geochemistry

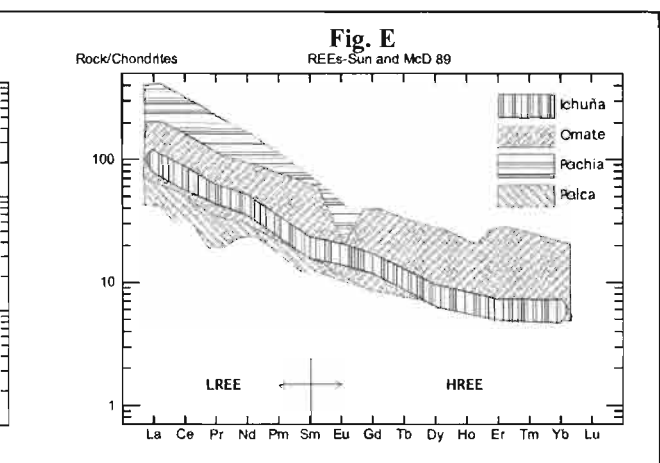
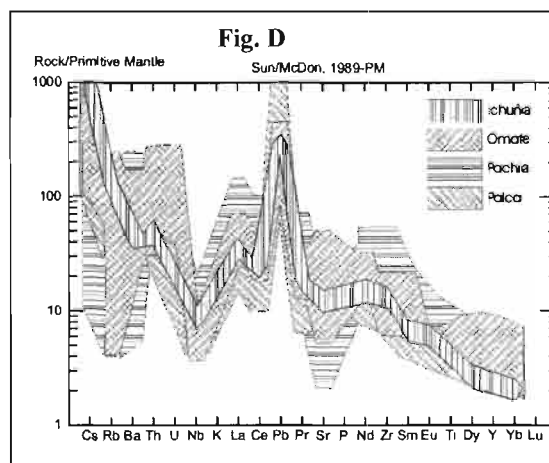
The volcanic sequence consists of andesitics and dacitic lava flows and rhyolitic ignimbrites. The TAS diagram confirms that in the Palca sector are mainly andesites and in the Omate sector are dacites showing a major range of differentiation. Their content of SiO₂ (from 58,8 to 66,4 % wt) in its majority they belong to the intermediate and acid rock group showing an affinity with andesites, dacites and rhyolites (fig A).

According to AFM diagram of Irvine and



Baragar, 1971 (fig B), they correspond to the cal-alkaline series (with a sample of Palca of incompatible behavior to the series). The Rickwood Diagram, 1980 (fig C), typically shows a basaltic and andesitic composition originated in a Volcanic Arc.

- The Rare Earth elements analyses (REE) have been plotted on a Spider diagrams normalized to Primitive Mantle (fig D). Nb, Rb Anomalies and LILEs and Pb enrichment show a strong evolution of the magmatic



materials of a typical compatible conduct of convergent margins (Martinez and Zuloaga 2.000). In Spider

Diagram standardized normalized to Chondrites (REE) enrichment in LREE is observed LHREE versus to HREE (fig E), that suggests a possible cortical thickening in process of formation. There is a slight depletion of HREE, that indicates the partial garnet presence in the original source. The anomaly in Eu suggests process of fractionated crystallization. The absence of enrichment of Fe during the differentiation, the enrichment of LREE and depletion of HREE indicates that the tectonic setting corresponds to an active margin.

The low content of Nb (average 8,00 ppm), according to Rubiolo et al. (2000) it is characteristic of arc volcanic rocks related to subduction processes.

Due to the low content of Ni (average 24,92 ppm) it would be primary magmas which indicate a genetic process to us of fractionated crystallization.

Conclusions

- The Formation Matalaque presents a lower sedimentary sequence with coarsening and thickening upwards evolution in which volcano-sedimentary deposits are prograded by agglomerate and volcanic conglomerates and an upper sequence (Qda. Pachas) coarsening and thickening upwards of fluvio-lacustrine environment.
- The samples for geochemical analyses in its majority corresponds to the lower-medium part showing that is a calc alkaline magmatism associate to an Active Continental Margin.
- The outcrops of the volcano sedimentary sequence of the Matalaque Formation restricted to the Western Cordillera with a direction associated to an Intra-arc basin.

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