PETROGENESIS AND OCCURRENCES OF GABROIC ROCKS IN THE LIMIT EASTERN CORDILLERA-HIGH PLATEAU IN THE ABANCAY DEFLECTION AREA (CURAHUASI -SOUTH PERU)

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RESUMEN.- Rocas gabroicas de tipo cumulats que constituyen la cámara magmática en el borde norte del batolito Andahuaylas-Yauri, afloran en la zona de la Deflexión de Abancay, como cabalgamientos plurikilométricos sobre cuarcitas del grupo Yura.

KEY WORDS.- Batholith, Gabbros, Abancay Deflection, Thrust, Curahuasi.

INTRODUCTION

Gabbroic rocks in the Curahuasi zone, north border of Andahuaylas-Yauri batholith, south of E-W striked Abancay Deflection, were described by MAROCCO (1975, 1978), however more detailed investigations about their origin and ocurrences have never been done. In this paper the authors provide information about field relations, petrography, rock and mineral chemistry. The conclusions could have important tectonic implications in setting the Eastern Cordillera-High Plateau limit as well as understanding the Andean shortening.

GENERAL GEOLOGY AND TECTONIC SETTING

Limestones and black shales of lower-middle Permic age (Copacabana Group), continental red beds and andesitic volcanics of upper Permic-Triassic age (Mitu Group) constitute the Paleozoic basament.

During the Mesozoic the basin was divided into two parts with different deposition, separated by E-W faults (Abancay Thrust systems), parallel to the Abancay Deflection (MAROCCO, 1978; LIGARDA et al, 1991). To the south the western basin consists of upper Sinemurian-Bajocian(?) limestones (Lagunillas Group), it follows the deposition of black shales and white quartzites interbedded at the top with limestones of Bathonian-Neocomian age (Yura Group) with more than 900 meters in thickness. This thick sequence, North of the eastern basin, is equivalent to only 15 meters of Neocomian mature sandstones (Huancané Formation), which overlies the volcanics of the Mitu Group (Figs. 1, 2); above the Huancané Formation are red shales and thick evaporitic series with limestones at the top of Aptian-lower Cenomanian age (Yuncaypata Formation).

The tectonic setting was characterized by E-W to WNW-ESE thrust systems, which dip to the south, downdip these faults become listric faults. The Abancay Thrust is the most important structure that puts, the Yura Group and Yuncaypata Formation together; associated with it are E-W isocline foldings in Puente Cunyac. Southward the subhorizontal dipped Curahuasi Thrust sets the gabbroic rocks over Yura Group quartzites, this can be seen in Quebrada Honda (Fig. 3). In the Curahuasi valley small tertiary stock of tonalitic rocks and quaternary shoshonitic volcanics are distributed along the E-W structures; the last one are associated with a distensive reactivation of the faults. Less important NW-SE faults with movement along the strike, associated with microdiorite dykes, are also present.

DISTRIBUTION AND PETROGRAPHY OF GABBROIC ROCKS

In a general way in the north border of the batholith, the Yura Group quartzites are overthrusted by the gabbroic rocks, as a response to the Curahuasi Thrust. Gabbroic rocks constitute in volume the main part of the magmatism, they are dark grey, and have magmatic laminations of cumulat type as a characteristic feature, their age is not well defined, but the authors assume that they intruded during the upper Cretaceous-lower Tertiary.

Modal Analysis using the IUGS diagrams, Pl-Px-Ol and Pl-Px-Hbl (Fig. 4) give three rock families: *troctolites, olivine gabbros and hornblende gabbros*. The *troctolites* and *olivine gabbros* show cumulat textures, with olivine-plagioclase-ortho-clinopiroxene as a prymary paragenesis. The post-cumulat or late magmatic phase consists of brown hornblende-biotite-opaques; the pyroxenes were altered to hornblende and opaques as simplectites. The hornblenda gabbros are dykes, which cut the troctolites and olivine gabbros, they show granular xenomorphic texture, and are made up of plagioclase-brown hornblende-clinopiroxene-opaques; olivine and orthopyroxene can be found occasionally.

MINERALOGY AND MINERAL CHEMISTRY

Minerals of olivine gabbros (samples Cu6, Cu7, Cu9) and troctolites (Cu10), were analized with a Camebax Microsonde (Lab. de Petrologie de l'Ecole Nationale Superieure des Mines de St. Etienne - Paris).

Olivine has a forsterite composition: $65<Fo<74$, with Magnesium content nearly 0.50% (Fig. 5); and contains inclusions of opaque minerals. Plagioclases are the dominant phase and have a subparallel arrangement that indicate the magmatic laminations; the anorthite content average goes from 60 to 74%: Labradorite-bytownite, however the anorthite content can have strong variations, which is typical of adcumulats cristallization. Clinopyroxenes are augite; whereas the orthopyroxenes are associated with both, clinopyroxenes and opaque minerals, and has hiperstene composition: $69<Mg<75$ (Fig. 5). The chemical evolution of these pyroxenes is like that of calc-alkaline plutonic rocks that evolved under high water fugacity (BEST & MERCURY, 1967), the titanium distribution between ortho and clinopyroxene shows that they are in equilibrium, therefore, it is assume that the cristallization temperature was about 1000° C (WELLS 1977). Amphibole cristallize as post-cumulats and has magnesium-hastingsite composition, showing high content of $Mg/Fe+Mg>0.85$ similar to the biotite: $Mg/Fe+mg>0.74$. Magnetite occurs as inclusions in olivine, associated with other ferromagnesian minerals. Illmenite is also present.

ROCK CHEMISTRY

Major-element composition and trace-elements abundances were analized by XRF-Fluorescence (Lab. de Petrologie de Paris VI) in the samples mentioned above. The diagrams A-F-M and Al_2O_3 - $FeO+Fe_2O_3$ - Mg, show typical calc-alkaline lineal evolution of cumulat rocks;

these gabbros are poors in both, alkalines and incompatible elements (Zr, Rb, Y, Nb, Hf) and are enriched in MgO, CaO, Ni, Co, V (Fig. 6). The comparision of the oxides against the differenciation index DI, with surrounding tonalitic stocks and microdioritic dikes, show that these gabbros are not comagmatic with the last one (LIGARDA, 1989). These chemical data also indicate that the gabbroic rocks are originated from a type I magma (CHAPPELL & WHITE, 1974).

CONCLUSIONS

Based on their mineralogical and petrographic characteristics and chemical data (cumulat rocks); it is belief that these rocks constitute the deepest level of Andahuaylas-Yauri batholith and probably represent the magmatic chamber, that were lifted by a plurikilometric overthrust from south to north (?) caused by thrust systems in the late Cretaceous. Also, these systems controlled the sedimentation in the western and eastern basins in the Jurassic and Cretaceous times, and later, during the andean tectonics, located the western basin over the eastern basin as an allochthonous block.

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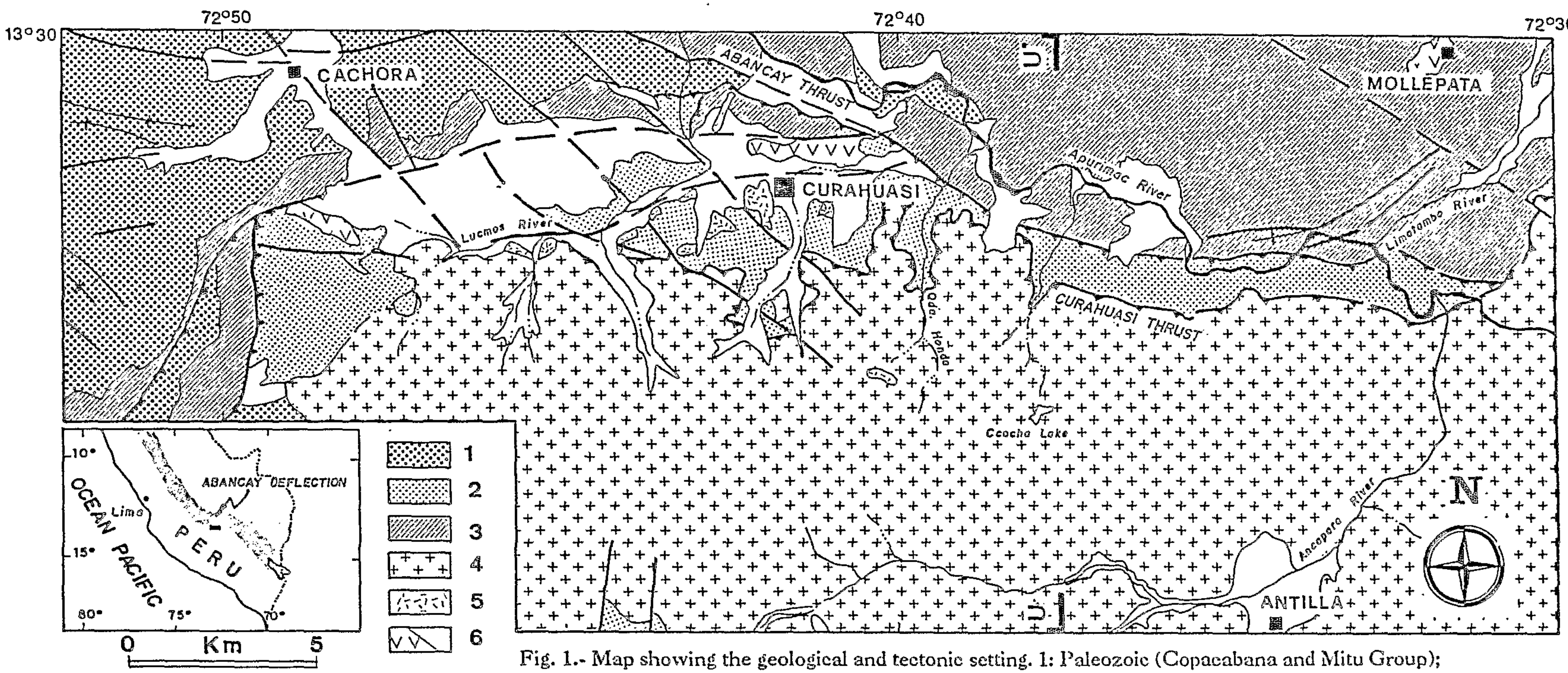

Fig. 1.- Map showing the geological and tectonic setting. 1: Paleozoic (Copacabana and Mitu Group); 2: Western Mesozoic basin (Lagunillas and Yura Group); 3: Eastern Mesozoic basin (Huancané and Yuncaypata Formations); 4: Gabbroic rocks of Andahuaylas-Yauri batholith; 5: Tonalitic stocks; 6: Shoshonitic volcanics/Quaternary deposits.

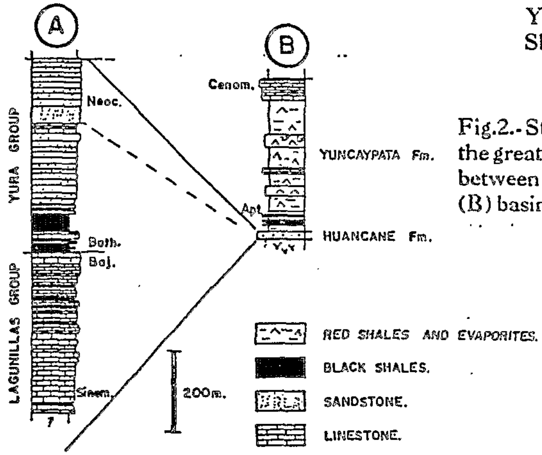

Fig.2.- Stratigraphic sections showing the great facies and thickness changes between the Western (A) and Eastern (B) basins during the Mesozoic times.

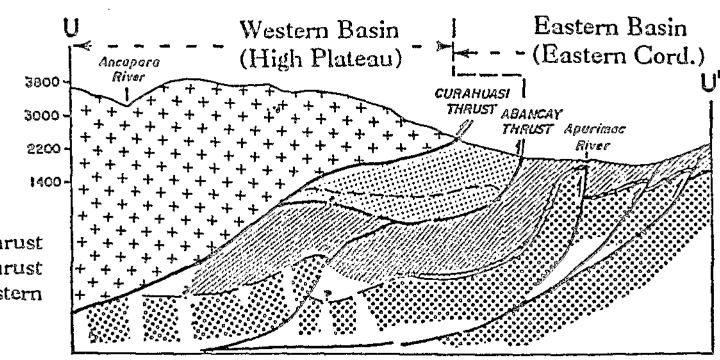

Fig.3.- N-S section showing the thrust systems, which cause the overthrust of the High Plateau against the Eastern Cordillera.

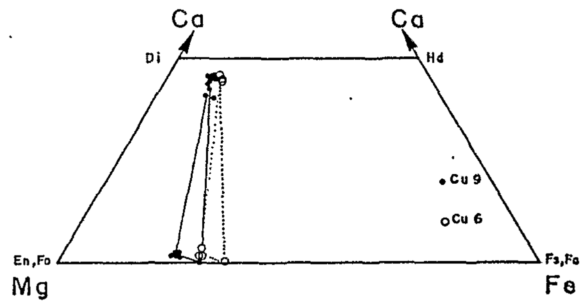

Fig. 5.- Ca-Mg-Fe diagram, showing the olivine-ortho-clinopiroxene equilibrium for two gabbroic rocks samples.

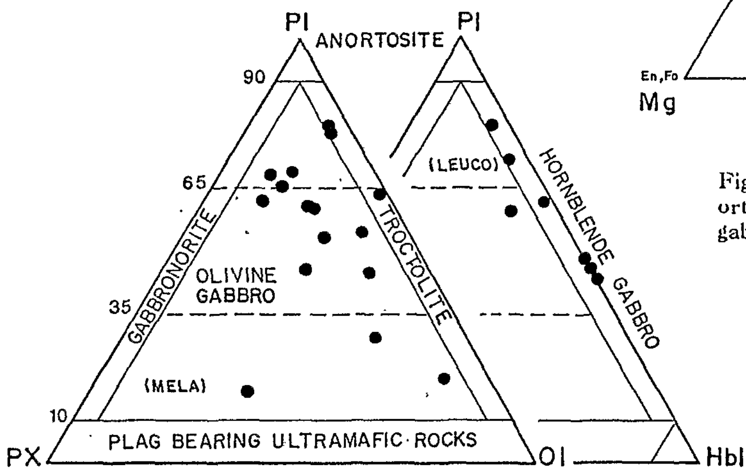

Fig.4.- Modal of gabbroic Rocks using the IUGS diagrams Pl-Px-Ol and Pl-Px-Hbl.

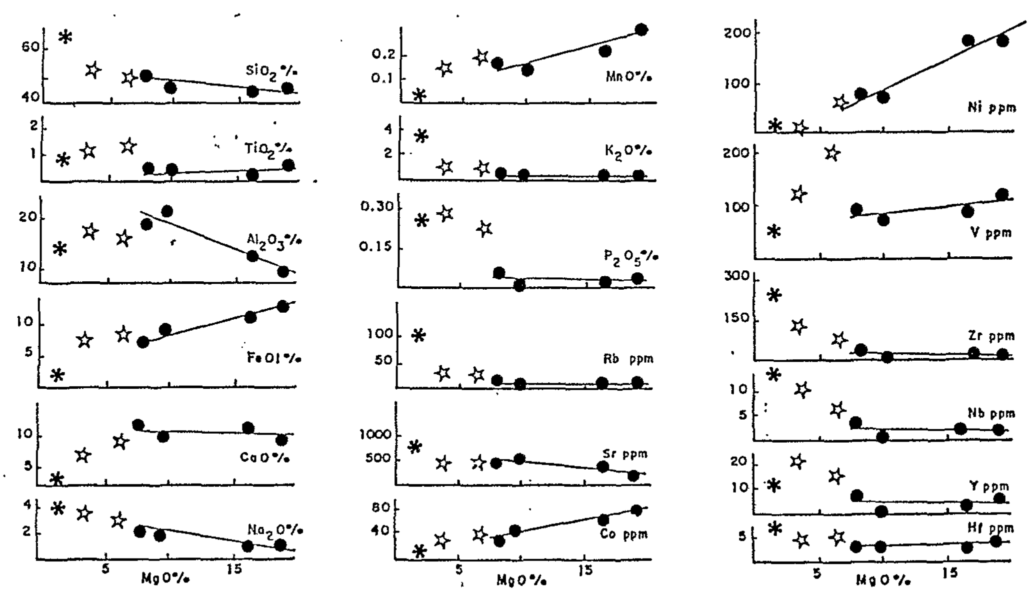

Fig.6.- Harker type diagrams of Curahuasi gabbroic rocks, compared with other magmatic events. circles: gabbroic rocks; stars: microdioritic dikes; asteriscs: tonalitic stock.