SEDIMENTATION, PALEOGEOGRAPHY AND TECTONIC OF THE CUZCO AREA BETWEEN KIMMERIDGIAN?-PALEOCENE TIMES : RELATION WITH THE SOUTH PERUVIAN MARGIN

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RESUMEN

Estudios de sedimentación, paleogeografía y tectónica de rocas del Kimmeridgiano?-Paleoceno de la región de Cusco, muestran que estas se depositaron sobre un umbral que separaba dos cuencas, las que se hallaban en una posición de tras arco distal y que registran eventos tectono-sedimentarios que están en relación con la evolución de la margen sur peruana.

KEY WORDS: sedimentation, paleogeography, tectonic, Kimmeridgian?-Paleocene, Cuzco, Peru.

INTRODUCTION

The tectonic and sedimentary evolution between Kimmeridgian?-Paleocene times of the Cuzco area (South Peru) is divided in 5 stages. The sedimentation developed over the Cuzco-Puno swell which separated the Western trough and the Eastern trough. The formation of the Eastern trough began during Kimmeridgian? times. This region in back-arc basin position recorded the external tectonic evolution of the South Peruvian margin.

GEOLOGICAL SETTING

During Mesozoic times, the Peruvian margin had a contrasted paleogeographic pattern (Jaillard, 1992)(Fig. 1). It can be divided into several NW trending zones, parallel to the subduction trench. In South Peru margin is possible to distinguish from W to E: 1) a narrow Coastal zone, which mainly comprises pre-Cretaceous rocks; 2) a Western subsiding trough which received thick marine sediments (presently Western Cordillera); 3) a positive swell, which received a reduced sedimentation (Cusco-Puno swell), and 4) an Eastern, less subsiding basin filled by mainly continental deposits (presently Eastern Cordillera).

During Kimmeridgian?, Cretaceous and Paleocene times, the sedimentation of the Cuzco area developed over the Cuzco-Puno swell which was emerged before latest Jurassic times.

GEOLOGICAL EVOLUTION (Fig. 2)

1. Kimmeridigian?-Berriasian? (Huambutio Fm).

The Huambutio Fm is composed by alluvial fan conglomerates (Lower Mb), thin marine limestone beds (Middle Mb), and continental sandstone, shales and conglomerates (Upper Mb). This formation is marked by numerous synsedimentary tectonic features which expresses a NW-SE trending extensional regime. During this period, the contrasted paleogeography is an effect of the beginning of the Eastern trough opening. All of this is interpreted as a distal consequence of the Araucan tectonic phase, which can be observed in North Chile and Argentina (Sempere et al. 1988).

In the Western trough developed a marine sedimentation and extensional regime related with the geodynamic events ocurred in the Paleopacific plate. So, the latest Jurassic-lower Neocomien period appears as a transition period between the convergence NNW-SSE Phoenix-South America (Bathonian-Kimmeridgian), and NE-SW (Valangian-Aptian)(Soler, 1991).

2. Neocomian (Huancane Fm).

The Huancane Fm is mainly composed by quartz white sandstones which are deposited in fluvial environments and which proceed from east. The clean neocomian sandstones are good expressed in the whole Peruvian territory (Moulin, 1989). In the Cuzco area, the fluvial sedimentation is mainly controlled by the eustatic sea level fluctuations (Carlotto, 1992). The eastern (Brazilian Shield) origin of the clastics can be interpreted as the result of the incipient rifting of the norther South-Atlantic Ocean (Jaillard, 1992).

The tectonic and magmatic quiescence in the whole Peruvian margin is related to the low convergence rate beetwen Phoenix-South American plates (Soler, 1991).

3. Late Aptian-Turonian (Lower Yuncaypata Gp).

The lower Yuncaypata Gp is characterized by the shallow internal carbonate platform evolution. This one began with a transition of late Aptian-middle Albian sandstones and shales that reached its maximum during the interval upper Albien-Turonian (Yuncaypata limestones). The limestones registered weakly extensive tectonic features.

In the Western trough developed a carbonate platform that is marked by a magmatic activity probably related to an arc (Albien-Cenomanian) and the beginnig of the emplacement of the Coastal Batholith. This period is related to a modification of the subduction, now with a low angle that correspond to a high convergence velocity that makes the oceanic slab become young. All of that, causes extensive and compressives tectonic phases well known in Central and North Peru, (Mochica phases) (Soler, 1991; Jaillard, 1992).

4. Senonian- Maestrichtian (Upper Yuncaypata Gp).

The Upper Yuncaypata Gp is divided in 3 major sedimentary secuences called M1, M2 and M3 (Carlotto, 1992). They are mainly composed by red shales, sandstones and evaporites. This time span corresponds to a global regressive period, which however registers weakly Santonian and middle Campanian transgressions. This regressive episod is related to the successive uplift of the Coastal zone (boundary Turonian-Campanian), followed by the uplift of the SW border (Santonian-Campanian), and later by the uplift of the NE border (Campanian-Maestrichtian) of the Western trough in association with progressive thrusting which develops foreland

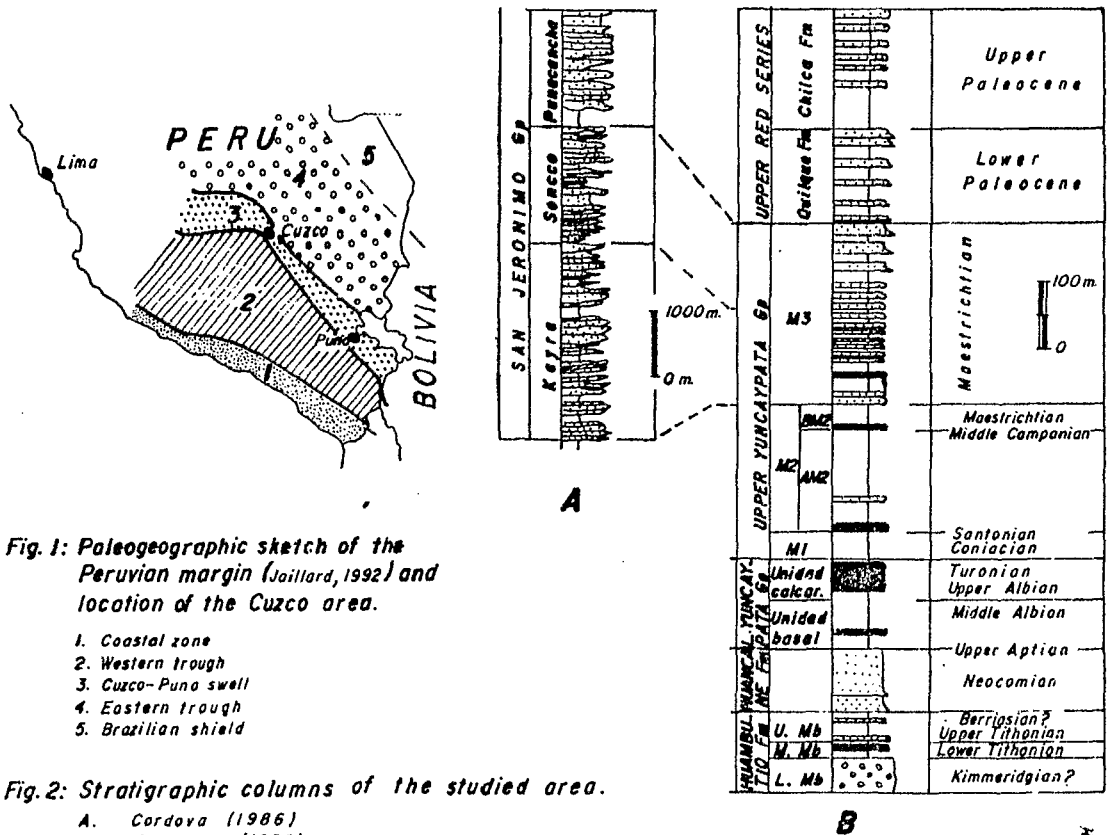


Fig. 1: Paleogeographic sketch of the Peruvian margin (Jaillard, 1992) and location of the Cuzco area.

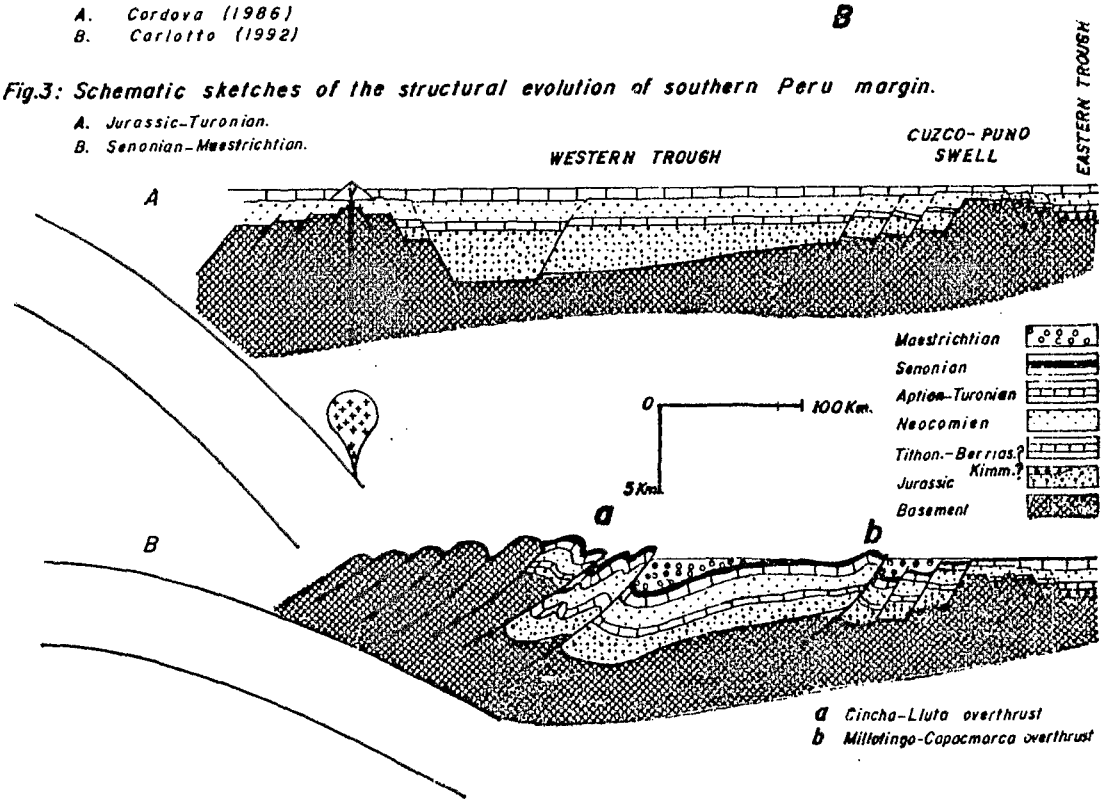
1. Coastal zone
2. Western trough
3. Cuzco-Puno swell
4. Eastern trough
5. Brazilian shield

Fig. 2: Stratigraphic columns of the studied area.

A. Cordova (1986)
B. Carlotto (1992)

Fig. 3: Schematic sketches of the structural evolution of southern Peru margin.

A. Jurassic-Turonian.
B. Senonian-Maestrichtian.



basins (Jaillard, 1992). So, a foreland basin develops during lates Campanian and Maestrichtian San Jeronimo Gp deposition. It was probably located at the boundary between Western trough and Cuzco-Puno swell, and it results the emplacement of the Millotingo-Capacmarca overthrust (Fig. 3). The foreland basin distal part was situated above the Cuzco-Puno swell, corresponding to the sequence M3. After, the San Jeronimo Gp thrust the Cretaceous-Paleocene autochtonous series (Red Beds Nappe).

All these tectonic events except the Red Beds nappe are known as the Peruvian tectonic phase, which is related, first, to a high convergence velocity of the Pacific and South American plates (Coniacian)(Soler, 1991; Jaillard, 1992), and second with the subduction of oceanic obstacle (Mollendo ridge)(Soler et al 1989) that provoked a magmatic gap and a compressive tectonic (progressive migration ot the thrusting toward NE).

5. Paleocene (Upper Red Series).

The Upper Red Series are composed by 2 formations: Quillque and Chilca separated by an unconformity. Each one explains the progradation of the fluvial deposits, the first one from SW origin, the second one from NE origin. Both, probably correspond to the foreland basin evolution.

In the Western trough a volcanic arc activity which began in the Maestrichtian times reached its maximum in the Paleocene times.

CONCLUSIONS

The tectono-sedimentary evolution in the Cuzco area between Kimmeridgian?-Paleocene can be divided in 5 stages grouped in 2 great periods. The first one (Kimeridgian?-Turonian) is mainly a distensive episod. The beginning corresponds to the Eastern trough opening in relation with the Kimmeridgian Araucan tectonic phase. In this moment, there is a change of the Phoenix and South American plates convergence. The ending is characterized by the subduction angle modification for the high convergence velocity of the Pacific and South American plates. The Second one (Coniacian-Paleocene) corresponds to a global regressive episod in association with progressive thrusting that develops the foreland basins. This period is related, first to the Peruvian tectonic phase which begins in the Coastal zone (lowest Coniacian times), and reaches the Cuzco-Puno swell (Maestrichtian). The origin is the high convergence velocity of Pacific and South-American plates and the subduction of oceanic obstacle (Mollendo ridge). Moreover, it is related with the tectonic phases of the boundary Maestrichtian-Paleocene and middle Paleocene.

This sedimentology and stratigraphic study evidence the nappe structure of the San Jeronimo Gp which overlies the Cretaceous-Paleocene autochtonous Cuzco series. Such a nappe is a new evidence of the important shortening ocurred in this part of the Andes.

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