GEODYNAMIC EVOLUTION OF THE MIOCENE DESCANSO-YAURI BASIN, CUSCO REGION, PERU

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KEY WORDS : Miocene, Sinorogenic basins, Cusco, Peru.

ABSTRACT

The Descanso-Yauri Basin is located south of Cusco (Peru), at the boundary between the Altiplano and the Western Cordillera. The basin has a NW-SE-oriented rhombohedric shape, and a continental sedimentary fill of Miocene age grouped in 3 members, all resulting from fault displacements along the boundaries of the basin. Folding along the northern margin dies out towards the basin's center. The stress tensors controlling the evolution of the basin are related with the regional stress field.

INTRODUCTION

The Neogene evolution of the Central Andes led to the development of small intermontane basins with their sedimentary and tectonic evolution tightly related to a continuous tectonic deformation. The Descanso-Yauri Basin belongs to a group of basins located along the transition zone between the Altiplano and Western Cordillera of southern Peru, immediately to the south of Sicuani (Cusco Dept.). It is NW-SE oriented, and covers an approximate surface of 2000 km2. The substrate of the basin presents rocks belonging to either the Altiplano or the Western Cordillera paleogeographic domains (Cárdenas et al, 1997; Carlotto, 1998). The boundary between these two domains is characterized by thepresence of regional faults controlling its evolution and mostly cropping out along the northern margin. The most conspicuous are the Langui, Descanso, and Yauri-Ocoruro faults . The basin has an elongated rhombohedric shape, limited to the northby the Descanso fault system, and to the SW by paleoreliefs of Mesozoic and Cenozoic rocks. The sedimentary infill is known as El Descanso Formation, consisting of conglomerates mostly crpping out towards the north, as well as sandstones, mudstones, and some limestone beds towards the south. To the E it unconformably overlies Eocene to earliest Miocene conglomerates and volcanic rocks, also sealing the NW-SE-oriented Yauri-Ocoruro fault. El Descanso Formation includes two volcanic tuff beds, onetowards thebase with an approximate age of 19 Ma, and another towards the top, with an average age of

11.5 Ma, which allow to consider this unit as Miocene. The NE margin of the basin presents tight folds which die out towards the center of the basin and are absent along the southern margin.

TECTONIC AND SEDIMENTARY EVOLUTION

The sedimentary evolution of the basin may be subdivided into 3 stages, corresponding to the 3 members of the El Descanso Formation. Member A (20-100 m) corresponds to the beginning of sedimentary infill of the Descanso-Yauri Basin. About 20 Ma ago, alluvial fan development began along the NW margin, due the activity along the Descanso and Langui faults. The SW margin remained apparently stable, and lacustrine deposition tookplace in the central part. The reliefs formed along the NW margin were active until about 19 Ma (Cerpa & Meza, 2001), as indicated by the lateral and foreward progradation of the alluvial fan deposits towards lacustrine deposits. The upper part of this member includes the Atunhuasi Tuff, which is used as the limit with the overlying member. This pyroclastic bed is dated in the region as being deposited at about 19 Ma (Boudesseul et al, 2000; Cerpa & Meza, 2001), and consists of a regional explosive event resulting in rhyolitic tuffs. The tuffs are subalkaline acid rocks, oversaturated in silica, peraluminous and potassic, transitional between the calcalkaline and shoshonite series.

Member B (50-700 m) corresponds to most of the sedimentary infill of the basin, and is unconformable with Member A. Deposition of Member B began at about 18 Ma with a SSE-sourced fluvial system probably due to reactivation of the Yauri-Ocoruro Fault. The slope of the system was rather low, thus leading to the developmentof small lakes in the central and NW areas. However, tectonic and sedimentary activity along the NE margin of the basin must have been continuous since 20 Ma, because the main drainages in Member B were along synclinal axes. Synclines formed between 18 and 19 Ma, and affect conglomerates of Member A. This rather continuous deformation originated progressive unconformities within the alluvial and fluvial deposits along the northern border of the basin. Sedimentation of Member B seems to have lasted until 13-12 Ma.

Deposition of Member C (50-200) began around 12 Ma with the development of deep braided which evolved towards a fine meandering fluvial system. The fluvial system comes from the SE and SW, due to the activation of the southern margin, i.e., the Yauri-Ocoruro fault, where alluvial fans and progressive unconformities developed. The NW margin continued active and developed alluvial fans nearby. Deposition of the base of the member is contemporaneous with explosive volcanic activity,which was dated (Ar/Ar ages on sanidine) as 12.82 ± 1.08 Ma (Cerpa et al. 2000), 11.74 ± 0.09 Ma and 11.66 ± 0.13 Ma (M. Fornari, *in* Cerpa & Meza, 2001). Later, deposition becomes lacustrine and *overfilled*, sealing progressive unconformities along the southern margin. However, this lacustrine system was subject to tectonic and climatic changes, leading to alternating depositional styles between *overfilled* and *balanced fill*. Lacustrine deposition progressively increased, until the basin filled in and greatlyextended its limits towards the south and west. Periferal areas developed small shallow lakes with carbonate deposition including algae. These beds have diatoms (De la Cruz, 1995), which provide a middle to late Miocene

age (Servant *in* Cerpa & Meza, 2001). Lacustrine sedimentation of Member C sealed progressive unconformities as well as the Yauri-Ocoruro fault, and lasted until about 10-9 Ma.

The Yauri tuff, interbedded towards the base of Member C of the El Descanso Formation, was deposited at about 11.5Ma. This rhyolitic tuff is transitional between the alkaline and subalkaline series. It is an acid, peraluminous and potassic rock, supersaturated in silica.

CONCLUSIONS

Deposition of the El Descanso Formation took place in a strike-slip basin beginningat about 20 Ma. Relief developed in relation to the Langui and Descanso faults, due to E-W oriented stress. The evolution of the sedimentary environments and of the synsedimentary tectonic structures show that the sedimentary fill of the Descanso-Yauri basin took place under a rather constant tectonic regime. The thickenning-coarsening sequence of Member B is related with NE-SW compression. As for Member C, the Yauri-Ocoruro fault acted as a sinistral strike-slip fault under E-W stress. The Descanso Faultwas active throughout the evolution of the basin, and was responsible for progressive unconformities along the northern margin. Folds along the northern margin die out towards the center (SW) of the basin, indicating a migration of strain in that direction. The Langui and Descanso faults are old structures which also controlled magmatism in the area. Stress tensors controlling the evolution of the Descanso-Yauri basin agree with the regional stress field for southern Peru (Carlotto, 1998).

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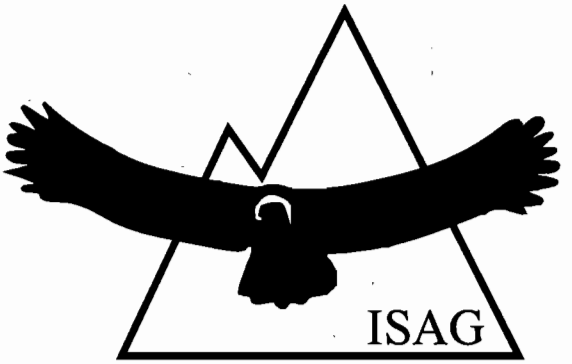

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L'organisation de l'ISAG 2002 et les bourses accordées à un certain nombre de collègues latino-américains ont été possibles grâce au soutien financier de l'IRD (notamment de la Délégation à l'Information et à la Communication), de la région Midi-Pyrénées, de l'Université Paul Sabatier et de l'Andean Comittee de l'ILP.