SEDIMENTOLOGIC EVOLUTION OF THE TINAJANI INTERMONTANE BASIN (LATE OLIGOCENE-MIDDLE MIOCENE, SOUTHEAST PERU)

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RÉSUMÉ

Le bassin intramontagneux de Tinajani (Oligocène supérieur-Miocène moyen; Altiplano du sud du Pérou) montre une évolution tectono-sédimentaire qui peut être divisée en 2 périodes. La première (membre inférieur) correspond au début du remplissage vers 28 Ma, en relation avec des mouvements sénestres-inverses (événement Quechua 0, 28-26 Ma). La seconde (membre supérieur) correspond au reste du remplissage et semble liée a l'événement Quechua 1 (20 Ma) qui produisit un jeu inverse des failles contrôlant le bassin.

INTRODUCTION

The Tinajani intermontane basin (Late Oligocene-Middle Miocene) is located in the Altiplano of southern Peru (Fig. 1). This basin was first studied by Audebaud & Vatin-Pérignon (1974) and considered to be Mio-Pliocene. Sébrier et al. (1988) assigned a Miocene age to the basin, based on some datations which however were not well located in the stratigraphic column.

The substratum of the Tinajani basin consists of Paleozoic rocks (Umachiri series), Triassic-Jurassic sandstones, Cretaceous strata (Ayavacas Formation and Vilquechico Group) and Eocene-Middle Oligocene deposits (Ayaviri Formation and Monterino volcanics). The Monterino volcanics (Florez & Rodriguez, 1999) or Lower Tinajani volcanics (Sébrier et al., 1988) were dated between 26 and 28 Ma (K/Ar; Bonhomme et al., 1985; Fig. 2).

The Tinajani basin has a rhombohedral shape elongated in a NW-SE direction. Its southern edge is controlled by the Pasani and Surimarca fault system, the northeastern edge by the Ayaviri reverse fault, and the northwestern edge by the Huisachita fault.

SEDIMENTOLOGIC EVOLUTION

The Tinajani Formation (Late Oligocene-Middle Miocene) which forms the basin infilling is divided in 4 sequences, named A, B, C and D (Fig. 2).

Sequence A (125-145 m) is conformed by pebbly facies of proximal alluvial fan origin, by sandy facies of a distal braided system, and argillaceous and calcareous facies of lacustrine environment. The sequence evolution is fining-upward and the paleocurrents are from the SW.

Sequence B (650 m) consists of sandy facies of braided rivers, pebbly facies of longitudinal bars and channels of proximal rivers, and lacustrine argillaceous facies, which are interbedded with volcanic tuffs. This unit is a fining-upward sequence that indicates retrogradation of the proximal environment installed in the NE and eastern edges of the basin.

Sequences A and B form a fining-upward megasequence (lower member; Fig. 2) that characterizes the beginning of the sedimentary infilling. This period starts ≈ 28 Ma (Quechua 0 tectonic event) in relation to sinistral inverse motions (caused by a E-W compression, Fig. 3), with the installation of alluvial fan deposits along the southern edge controlled by the Pasani and Surimarca Faults. In the distal part (north) lacustrine deposits developed. Later on, the Pasani and Surimarca Faults stabilized, and the Ayaviri Fault controlled fluvial sedimentation proceeding from the NE (Fig. 3).

Sequence C (150 to 450 m) consists of sandy facies of proximal braided rivers, pebbly facies of proximal rivers and of alluvial fans, which show a coarsening-upward evolution. The alluvial fans are located along the NE and SW edges. Near the base of the unit, volcanic tuffs are dated (K/Ar) between 18 and 14 Ma (Bonhomme et al, 1985, Fig 2), and at 20.5 ± 0.7 Ma (Carlotto, unpublished).

Sequence D (370-160 m) exclusively consists of sandy and conglomeratic (debris flow) alluvial fans coming from the SW. They form coarsening-upward sequences.

Sequences C and D form a coarsening upward megasequence (upper member; Fig. 2) that indicates closure of the basin. This period seems to be in relation with the Quechua 1 tectonic event (20 Ma) that produced reverse motions (compression NE-SW) of the Pasani and Ayaviri faults, creating reliefs that fed alluvial fans and proximal rivers (Fig. 3). Later on, only the Pasani and Surimarca faults were active, feeding fans toward the NE, and also producing NW-SE folds and progressive unconformities.

The Pasani and Ayaviri faults that have controlled the evolution of the Tinajani basin are the structural limits of a threshold which is the continuation of the Cusco-Puno Threshold studied in the Cusco region (Carlotto, 1998). It is on this structural high that the Tinajani basin developed.

Gabbroic and granodioritic plutons are located south of the Pasani and Surimarca faults (Carlier et al., 1996). Erosion of reliefs produced by the surrounding uplift provided detritic material which filled the Tinajani basin, which is compatible with the paleocurrents data.

CONCLUSIONS

Intermontane basins (Late Oligocene-Middle Miocene) aligned on strike-slip faults, are located in the Altiplano and in the Eastern Cordillera-Altiplano limit (Punacancha, Pusi-Capachica, Crucero, Rumichaca, Tinajani basins). These basins present a beginning stage and a closing stage. The filling beginning is related to sinistral transtension or transpression movements along the faults that define the basins, during the Quechua 0 tectonic event (28-26 Ma). The closing of those basins implies reverse and reverse-sinistral motions due to a NE-SW compression, in relation with the Quechua 1 tectonic event (20-17 Ma). These periods of beginning and of closing of the basins seem to coincide with changes in the speed and direction of the Nazca and South American plates, particularly around 26 Ma and 20 Ma.

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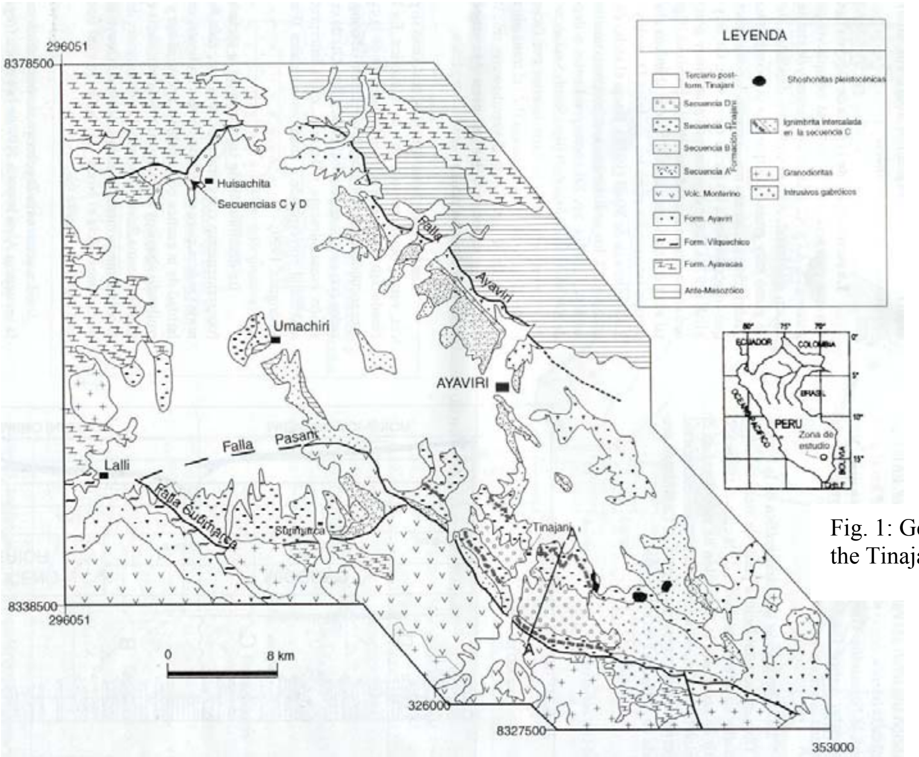

Fig. 1: Geological map of the Tinajani Basin

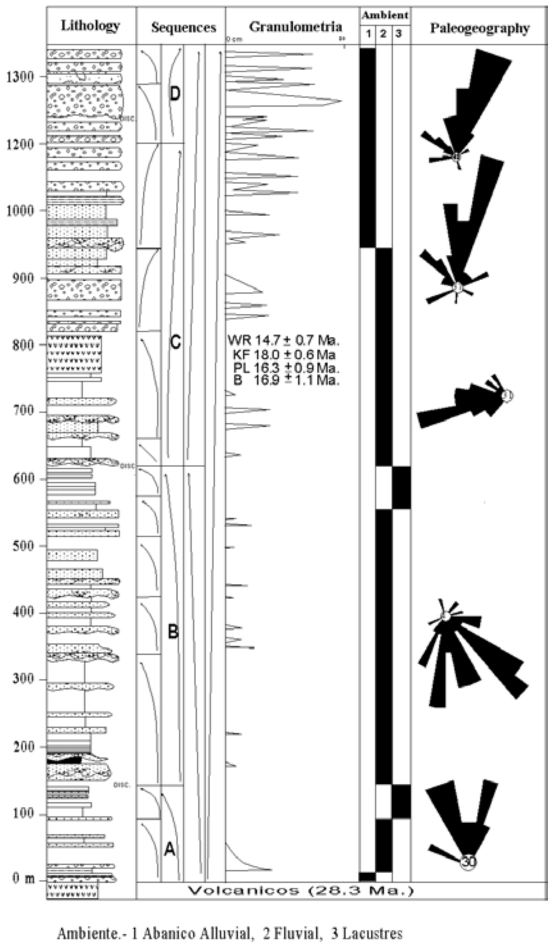

Fig. 2: Lithostratigraphic log of the Tinajani Basin sediments

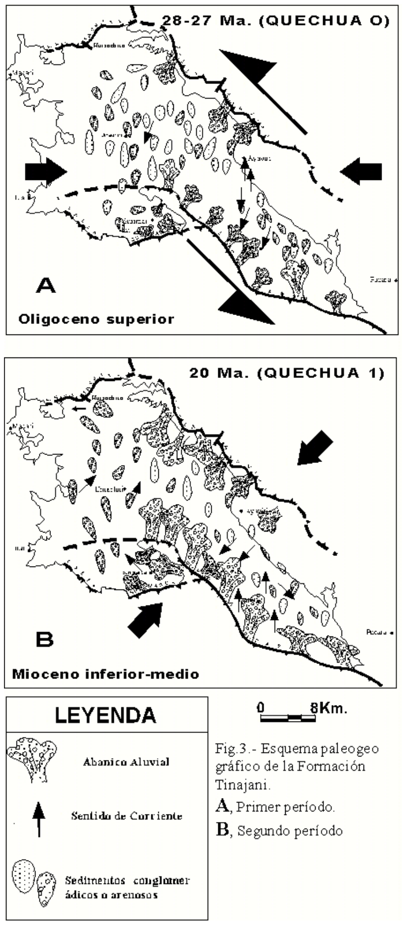

Fig. 3: Paleogeographic map of the Tinajani Formation