A SHORT-LIVED COMPRESSION RELATED SEDIMENT FILL IN THE ANDEAN INTERMOUNTAIN BASIN OF NABÓN (LATE MIOCENE, SOUTHERN ECUADOR)

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RESUMEN: El relleno volcano-sedimentario de la cuenca del tipo cono aluvial y fluvio-lacustrin fue depositado hace ≈ 8 Ma (dataciones por trazas de fisión y datos paleomagneticos). Las deformaciones sinsedimentarias permiten determinar un regimen compresivo durante el relleno.

KEY WORDS: Ecuador, Miocene, intermountain basin, basin analysis, zircon fission track, paleomagnetics.

INTRODUCTION

The Nabón basin is an elongated NNE-SSW oriented structure of ca. 120 km^2 situated in the Interandean depression south of the town Cuenca. The basin fill (500-600m) consists of volcaniclastic and pyroclastic continental deposits which overlies a volcanic series of mostly ignimbrites. The basin is a part of several Interandean continental basins (Cuenca, Girón, Loja etc.) formed after the Paleocene-Eocene accretion of the Piñon/Macuchi arc terrain and during the Tertiary subduction of the Nazca plate with related volcanic activity and uplift of the Ecuadorian Andes (e.g. Daly, 1989). In southern Ecuador a latest Oligocene to Miocene age of basin opening and filling under compressive strike-slip movements is generally assumed (Noblet et al., 1988, Lavenu et al., 1992). The reconstruction of the sedimentary history and synsedimentary deformation reveals the tectonic evolution of this part of the Andean chain (e.g. Noblet & Marocco, 1989, Lavenu et al., 1990). We present new data from the Nabón basin concerning the age and evolution of the sediment fill and its deformation.

RESULTS

The basin is floored by an ignimbrite series (Saraguro Fm.) dated by zircon fission track at 29-23 Ma. The oldest basin fill deposits (Fig. 1) are composed of reworked tuffs and alluvial fan system sediments followed by braided river deposits. For a short period the center of the basin was occupied by a lake with high detrital sediment input and few diatomite layers (Letrero Fm.). Afterwards braided river and alluvial fan deposition is generally re-established. The basin fill series is topped discordantly by thick volcanic debris flows and pyroclastics. According to sediment geometries, flow indicators and the presence of reworked metamorphic pebbles characteristic of the eastern Andean cordillera the basin was mainly supplied from the eastern to the northern edge.

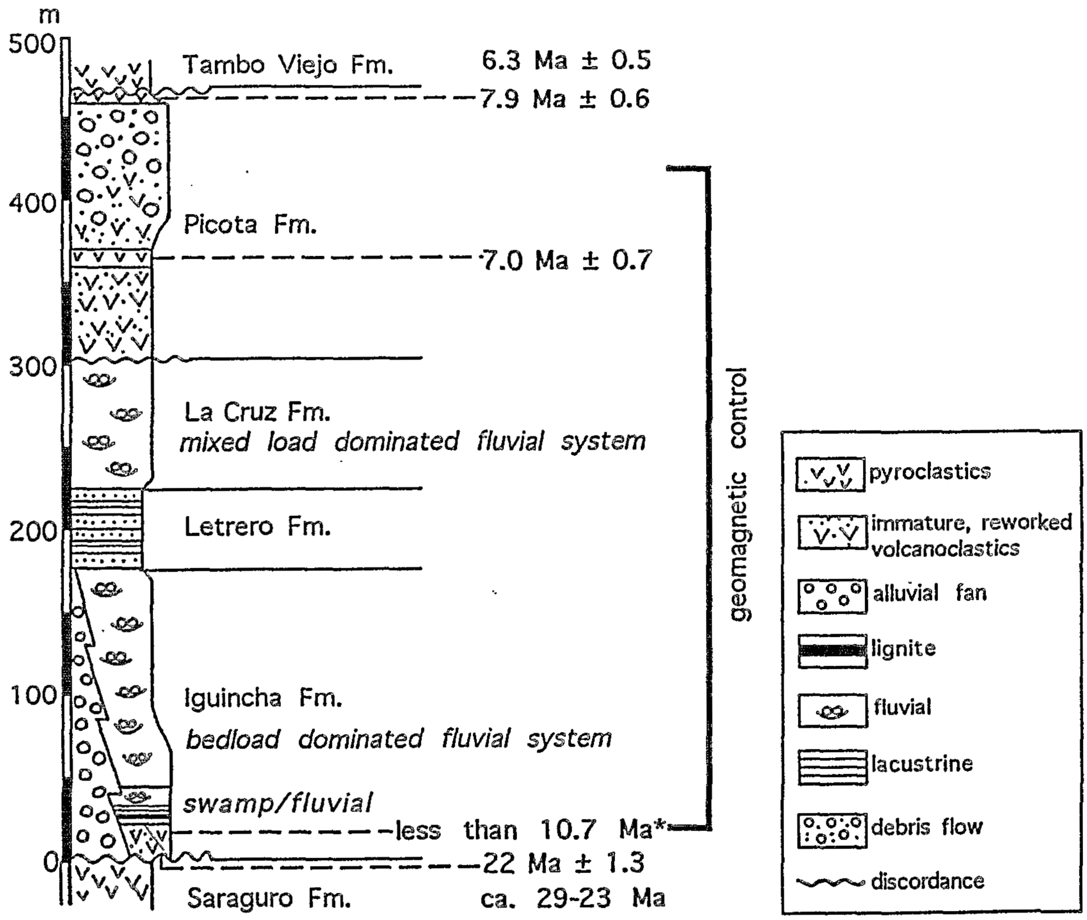

Fig. 1: Simplified stratigraphy and sedimentology of the Nabón basin. Only fission track data from samples without and minor (*) detrital component are shown. Error is ± 1 s.

The zircon fission track ages from two pure ashfall tephra in the upper part of the series range from 7.0 to 7.9 Ma. Many other samples contain some detrital component (see e.g. a 10.7 Ma* mean age at the base of the basin fill in Fig. 1) but there is always a younger mode at 8 Ma. The statistical extraction of the precise eruption ages is in progress. Younger volcanic air-fall deposits considered as Tarqui Fm. (DGGM, 1982) are scarcely preserved and one zircon fission track sample points to an age of 6.3 Ma (our Tambo Viejo Fm. in Fig. 1). Geomagnetic measurements reveal a reversed polarity for most of the basin fill (see Fig. 1) and combined with the fission track data it appears that the sedimentation occurred mainly during the 4r paleomagnetic chron (8.5-7.9 Ma in Cande & Kent, 1992). Tectonic block rotation was only detected in the volcanic basement (see Fig. 2). Therefore, we observe a long time gap between basement formation and the main basin fill. This time is documented only by very few relic fluvial/alluvial sediments.

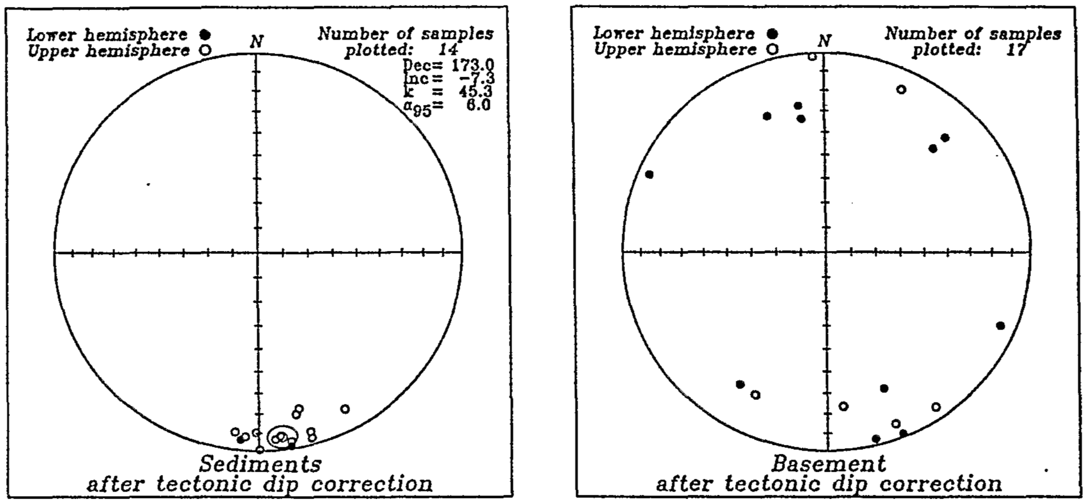

Fig. 2: Geomagnetic measurements obtained from the sediment fill and basement of the Nabón basin (it is to note that the indicated numbers of samples represent numbers of drill sites each one comprising 3-4 measured samples).

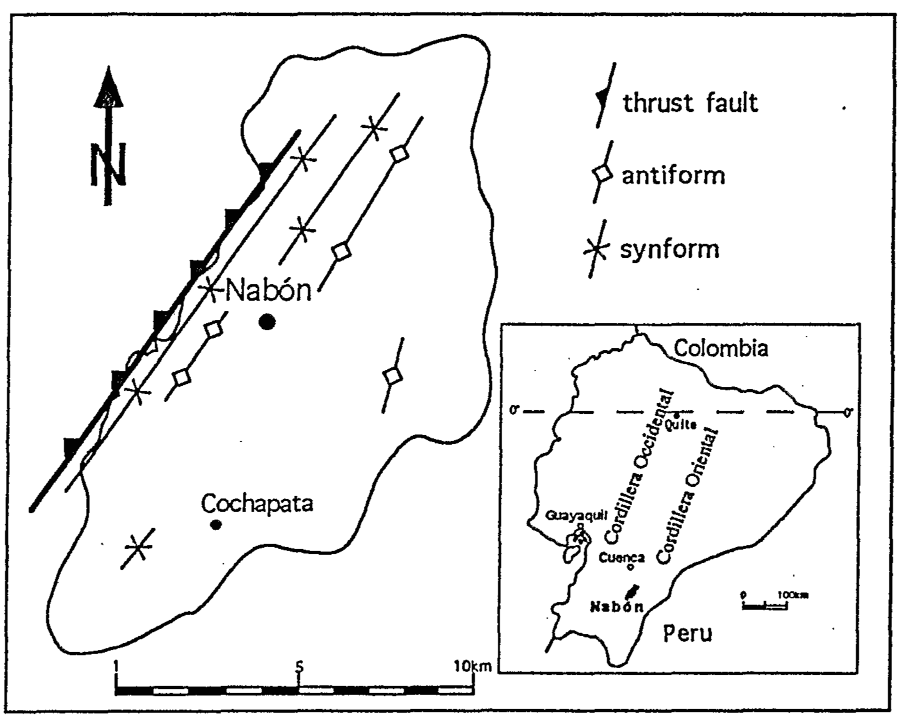

Fig. 3: Sketch of the main synsedimentary tectonic structures affecting the Late Miocene sediment basin fill.

The presence of synsedimentary thrusts along and near the western basin edge, growth folds striking parallel to the basin edge and related, orthogonally oriented normal faults point to a compressive tectonic regime that was active during the time of the main sediment fill (Fig. 3).

CONCLUSIONS

It appears that the tectonic structure hosting the young Nabón basin fill was formed at the transition between Oligocene and Miocene (probably as a part of a larger strike-slip system as proposed for other intermountain basins in southern Ecuador) but at first erosion and by-pass prevailed. Due to later compression (around 8 Ma, Late Miocene) and pronounced alluvial fan sedimentation it was partly closed and general sediment fill was enabled. The unconformable covering of the basin fill series by younger pyroclastics indicates that erosion and by-pass were re-established soon after sedimentation. The time of the observed local compressional regime coincides with the known general Miocene compressive stage (e.g. Lavenu et al., 1992) and the assumed accelerated subduction (Daly, 1989) at the Ecuadorian trench from Middle Miocene to Pliocene.

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