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An aborted rift process of Aptian-Albian age in central Peru, and its significance for the margin geodynamics

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INTRODUCTION

Early studies between 1924 and 1970 in the Peruvian Central Andes described a volcano-sedimentary sequence to the top of Goyllarisquizga Group, in some cases including it in this group. In the last 30 years, works in Central Peru referring to the Cretaceous (e.g. Chayllacatana Formation) do not give importance to these volcano-sedimentary deposits. Recently Romero et al., 2004 developed the first geodynamics interpretations of these sediments assumed the sedimentation during Lower Albian in the Central Peru. Other works in south Peru mentioned volcano-sedimentary deposits in the Matalaque Formation but they do not give a basin geodynamic interpretation. This work tries to understand the geodynamics of the Peruvian continental margin during the Aptian-Albian, for it we focused in the study of Chayllacatana and Matalaque basins.

STRATIGRAPHY

Previous studies of the Cretaceous (Benavides 1956, 1999; Wilson 1963; Moulin 198; Jaillard et al., 1997) not give importance to the volcano-sedimentary deposits between Aptian-Albian in Central Peru (e.g. Chayllacatana Formation) and in south Peru (e.g. Matalaque Formation) reason for which, we will give emphasis in these Formations.

In the Western Cordillera, the Lower Albian unites, are represent for the Inca and Pariahuanca Formations (Benavides 1956, Wilson 1963), overlying discordant the Goyllarisquizga Group and underlying concordant the Chulec Formation. It consists of calcareous sandstones, ferruginous calcareous intercalated with gray limestones. **In the Altiplano**, the Aptian-Albian represents of Pariahuanca Formation and Chayllacatana Formation (Yates et al., 1951). The Pariahuanca Formation, is assigned to the Lower Albian in the Western Cordillera, but Upper Aptian-Lower Albian in the Altiplano (Moulin 1989). The Chayllacatana Formation lies discordant the Goyllarisquizga Group (Berriasian-Aptian), and underlying concordant the Chulec Formation (Lower-Middle Albian) outcrops arises throughout a strip NO-SE with 370 km length and 35 km wide (Fig. 1).The base consists of sandstones, conglomerates and red limestones, the middle and upper part have lava flows (e.g. olivine basalt) in some place with pillow structures (Fig. 2). Noble el al., 2001 reported a basalt age of 109.2 ± 1.6 Ma from this unit. Nevertheless, the lava flows are only in the middle and upper part, we suppose that the dated sample

corresponds to these parts; and the base could be pre Albian and probable include the Upper Aptian, which agree with the age of Pariahuanca Formation (Moulin 1989). **South of Peru**, the Aptian-Albian is represents by the Murco Formation (Arequipa) and Matalaque Formation (Moquegua-Tacna). The last unit consists of volcanic flows, tuff, sandstones and gray shale. This unites overlying the Hualhuani Formation (Neocomiano) and underlying the Arcurquina Formation (middle Albian-Turonian); reason because it is considered Lower Aptian-Albian age.

TECTONICS

In the Western Cordillera of Central Peru, the faults are low angle inverse, like overthrusting tilted to the NE, affecting the Cretaceous sequence. In the central part between Huancavelica and Cerro de Pasco, where Chayllacatana Formation arises (boundary Western Cordillera-Altiplano), the faults system are with greater angle and inverse components, making arise in some places the rocks of Marañón Complex. In the South Peru, as main structures is the Incapuquio-Cincha Lluta fault system, which corresponds to a transpressive structure.

MAGMATISM

In 1989 Soler studied the Central Peru and mentioned the presence of basaltic lavas from Chayllacatana Formation, this lavas are alkaline and intra continental almost primitive rocks, product of fusion of an enriched subcontinental mantle and this magmatism took place under a distensive tectonic regime, and the lavas have any relationship wuth subduction process. Lavas of Yauyos area have a lead isotope ratio $^{206}Pb/^{204}Pb$=18.51, $^{206}Pb/^{204}Pb$=15.63, $^{206}Pb/^{204}Pb$ = 38,42 (Mamani M. in preparation) that compared to the magmatism of south from Central Andes, the Pb-isotope ratios are similar to the Rift Central Argentina that development during the Cretaceous ~90 Ma (Lucassen et al., 2002). Pb-isotopes ratios of Yauyos are between radiogenic and unradiogenic values. Cervantes J. (present symposium) mentioned that the rocks of Matalaque Formation are cal-alkaline series related to subduction process.

GEODYNAMICS

After the sedimentation of the Goyllarisquizga Group (reverse-graded sequence) (Fig. 3A), in the Late Aptian, a tectonic instability started in the Central Peru, initiating a normal-graded sequence (Pariahuanca and Chayllacatana Formations). This sequence indicates deposits by retrogradation, produced partly by a transgression and by subsidence in a extensional tectonic environment. Later in the Early Albian (Fig. 3B) in agreement with the extensional tectonic environment the faults had greater normal displacements, causing a cortical thinning, and permitted a basic volcanism along the fault emplaced in marine basin, demonstrated by pillow structures and series of the Pariahuanca Formation. Also in south Peru in the Early Aptian-Albian occurred the opening and development of the Matalaque basin, depositing a marine-continental sequence. Finally, in the Early-Middle Albian (Fig. 3C), it was a progressive tectonic stability attenuating the distensive tectonic environment and depositing limestone of the Chulec and Arcurquina Formations.

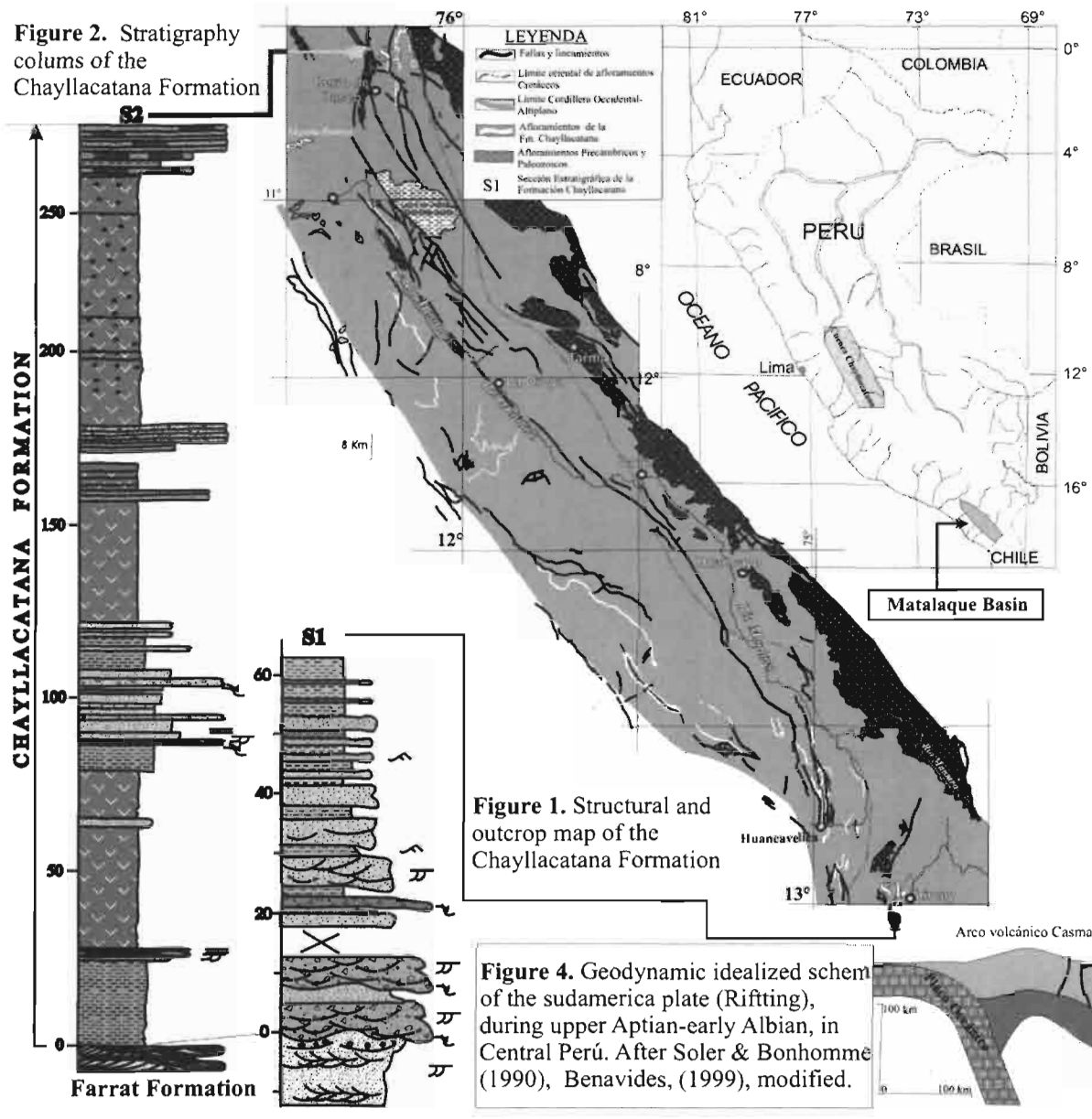

Figure 2. Stratigraphy colums of the Chayllacatana Formation

Figure 1. Structural and outcrop map of the Chayllacatana Formation

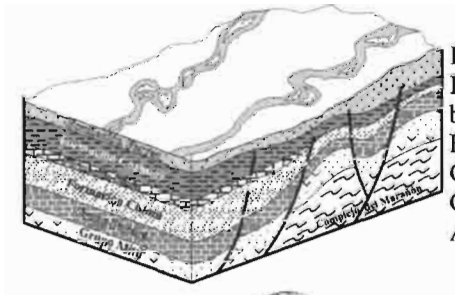

Fig. 3A. Paleogeographic block diagram for Farrat Formation-Goyllarisquizga Group (upper Aptian)

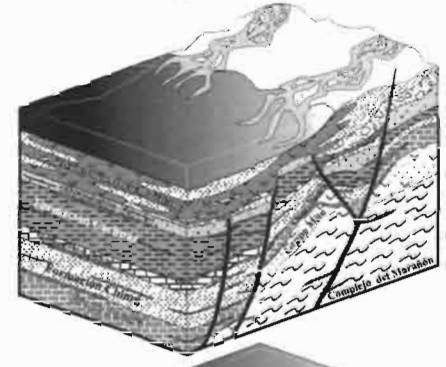

Fig. 3B. Paleogeographic block diagram for Chayllacatana Formation (upper Aptian-early Albian)

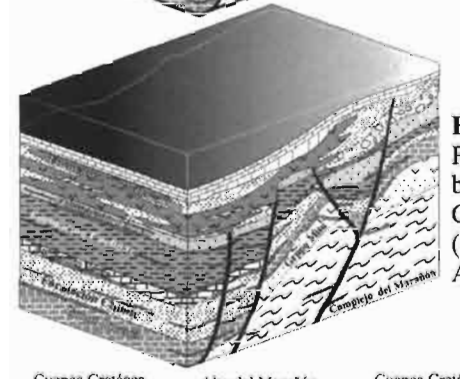

Fig. 3C. Paleogeographic block diagram for Chulec Formation (early-middle Albian)

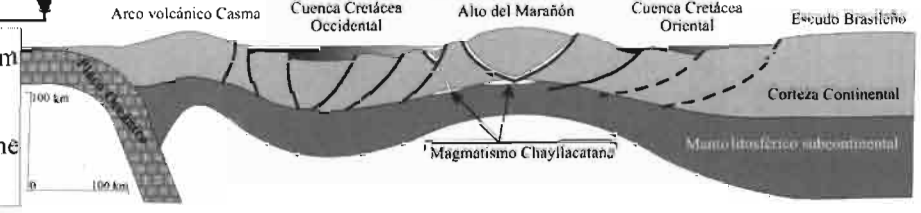

Figure 4. Geodynamic idealized schem of the sudamerica plate (Riftting), during upper Aptian-early Albian, in Central Perú. After Soler & Bonhomme (1990), Benavides, (1999), modified.

CONCLUSIONS

Continuing with the interpretations from Romero et al., 2004; in Central Peru, during the Aptian-Albian developed a Rift process (Chayllacatana basin), whose axis coincided with the present Eastern Cordillera-Altiplano; caused by isothermal ascent of the underling mantle; producing a alkaline magmatism and as well a swelling up being a positive zone, called "Alto del Marañón" (Fig. 4). An argument that indicates the axis rift in that position, was the variation of the age of the Pariahuanca Formation, from Upper Aptian-Lower Albian (in the Altiplano) to Lower Albian (in the Western Cordillera). At the same time the Matalaque and Casma marginal basins were developed. Later in the Lower-Middle Albian (≈107 Ma), the process of rift is probably aborted, due an increase in the speed of the Nazca plate convergence and South American (Soler & Bonhomme 1990). Finally we concluded that the Late Aptian-Early Albian, seems to correspond to the periods of greater extension during the Cretaceous to the level of Peruvian continental margin, which originated Rift type and marginal basins.

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