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THE GEODYNAMIC EVOLUTION OF THE SOUTHERN CENTRAL ANDES CONTINENTAL MARGIN (NW ARGENTINA, N CHILE) DURING THE PALAEOZOIC, WITH EMPHASIS ON THE ORDOVICIAN AND SILURIAN

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The geodynamic evolution of the Palaeozoic continental margin of South America in the southern Central Andes is characterized by the westward progression of orogenic basins from the Ordovician to the Early Triassic (Fig. 1).

ORDOVICIAN

The Ordovician basin in the NW Argentinian Cordillera Oriental and Puna originated as an Early Ordovician back-arc basin (Bahlburg 1991). The contemporaneous magmatic arc of an east-dipping subduction zone was presumably located in N Chile and may have in parts corresponded to the magmatic belt of the Faja Eruptiva de la Puna Occidental (FEW; Palma et al. 1986; Niemeyer 1989). In the back-arc basin, a 3500 m, fining-up volcanoclastic apron connected to the arc formed during the Arenig. Increased subsidence in the late Arenig allowed for the accomodation of large volumes of volcanoclastic turbidites during the Middle Ordovician. Subsidence and sedimentation were caused by the onset of collision between the para-autochtonous Arequipa Massif Terrane (AMT) and the South American margin at the Arenig-Llanvirn transition. It led to eastward thrusting of the arc complex over its backarc basin and to its transformation into a marine foreland basin. As a result of thrusting in the W, a flexural bulge formed in the E, leading to uplift and emergence of the Cordillera Oriental shelf during the Guandacol Diastrophic Phase at the Arenig-Llanvirn transition. The basin fill was folded during the terminal collision of the AMT in the Oclóyic Orogeny (Ashgill). The orogeny led to the formation of the positive area of the Arco Puneño.

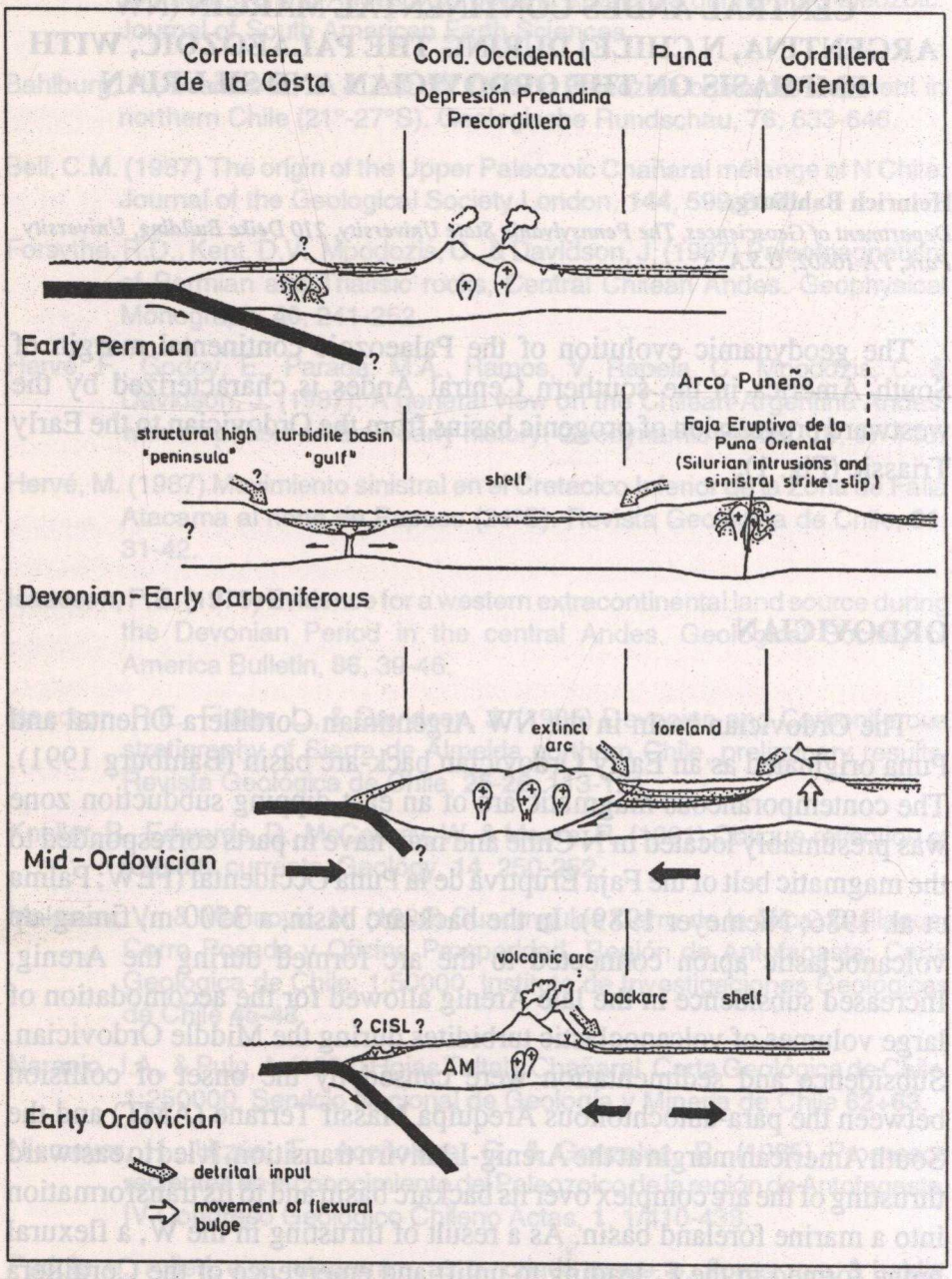

Fig. 1: Schematic cross sections outlining the geodynamic evolution of the southern Central Andes between 21° and 27° S during the Paleozoic.

SILURIAN

Faja Eruptiva de la Puna Oriental (FEE)

The magmatic rocks of the FEE are exposed in a N-S striking belt at the eastern margin of the southern and northern Puna. Previously, the FEE has been described either as siliceous plutons intruding the Ordovician sedimentary rocks (e.g. Méndez et al. 1973) or as submarine lavas and ignimbrites intercalated with the Ordovician strata (e.g. Coira et al. 1982).

Following the latter description, the FEE has been interpreted as an Ordovician volcanic arc and the Ordovician basin in the Puna as a fore-arc basin (e.g. Coira et al. 1982; Hervé et al. 1987). Subsequently, geotectonic scenarios including one or two east- and/or west-dipping subduction zones with the FEW and FEE as the respective magmatic arcs were developed (Dalziel & Forsythe 1985; Ramos 1988).

However, in a recent study of the FEE in the northern Puna no volcanic rocks were observed, intrusive contacts between the FEE and the folded Ordovician country rocks are clearly visible (Bahlburg 1990). Therefore, a very Late Ordovician to Silurian age of the FEE has to be inferred (Bahlburg et al. 1990). Accordingly, the Ordovician Puna basin can not have been in a fore-arc position (see above).

The FEE consist of porphyritic and equigranular, partly hypabyssal granitoids rich in sedimentary xenoliths. Their unimodal composition (SiO_2: 64-73%) characterizes the plutons as products of calc-alkaline differentiation processes. The intrusives are peraluminous and corundum normative (CIPW; Bahlburg 1990). Significant upper crustal contamination of the FEE magmas is indicated by high Sri values (0,7183, 0,7100) of some granitoids (Omarini et al. 1979, 1984) and the abundance of sedimentary xenoliths in the intrusives.

The FEE is cut by a N-S striking subvertical foliation which is differentially developed in broad shear zones. In thin section, deformed biotites reveal that the shear zones accomodated sinistral strike slip. Shearing took place at temperatures of between 300 and 500°C as indicated by core and mantle structures in quartz and the absence of recrystallization of plagioclase (Voll 1976). The sedimentary host rocks are in general unaffected by these shear movements.

The emplacement of the FEE probably took place in a regional, sinistral strike-slip zone during or after the collision of the AMT in the Oclóyic Orogeny. The association of a strike-slip regime with this collision points to a transpressive character of the shear zone. Thus, the collisional processes taking place farther west potentially led to a thickening of the crust through transpression in the eastern Puna, and initiated the formation of the FEE.

Salar del Rincón Formation (SRF)

On the basis of brachiopod collections, the SRF has been assigned alternatively to the Early Devonian (Aceñolaza et al. 1972) or to the Early Llandovery (Isaacson et al. 1976). A new collection at the type locality realized together with M.C. Moya, Salta, yielded a fauna corresponding to the one of Isaacson et al., corroborating the Early Llandovery age (Boucot pers. com). The SRF is c. 120 m thick and grades from fluvial to shallow subtidal facies. The SRF overlies Ordovician strata with an angular unconformity, its top is cut by an erosion surface. The SRF documents a short lived transgression resulting in a type 1 sequence.

DEVONIAN-EARLY CARBONIFEROUS

West of the Arco Puneño, a further marine basin developed during the Early Devonian, the eastern shelf of which occupied the area of the Cordillera Occidental, Depresión Preandina and Precordillera. The corresponding deep marine turbidite basin was located in the region of the Cordillera de la Costa. Deposition continued until the basin fill was folded in the Early to early Late Carboniferous Toco Orogeny. The basin originated as an extensional structure at the continental margin of Gondwanaland. Independent lines of evidence imply that basin evolution was not connected to subduction (Bahlburg this congress). Thus, the basin could not have been in a fore-arc position as previously postulated (e.g. Hervé et al. 1987).

LATE CARBONIFEROUS-MID TRIASSIC

Above the folded Devonian-Early Carboniferous strata, a continental

volcanic arc developed from the Late Carboniferous to the mid Triassic. It represents the link between the Choiyoi Province in central Chile and Argentina, and the Mitu Group in southern Peru. The volcanic arc succession is characterized by silicic lavas and tuffs, and volcanoclastic sedimentary rocks. During the latest Carboniferous, a thick lacustrine unit formed in an extended lake in the area of the Depresión Preandina. This lake basin originated in an intra-arc tensional setting (Breitkreuz in press). In the Early Permian, marine limestones were deposited on a marine platform west and east of the volcanic arc, connected to the depositional area of the Copacabana Formation in southern Peru.

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