A CARBONIFEROUS VOLCANIC ARC ALONG THE COASTAL CORDILLERA?

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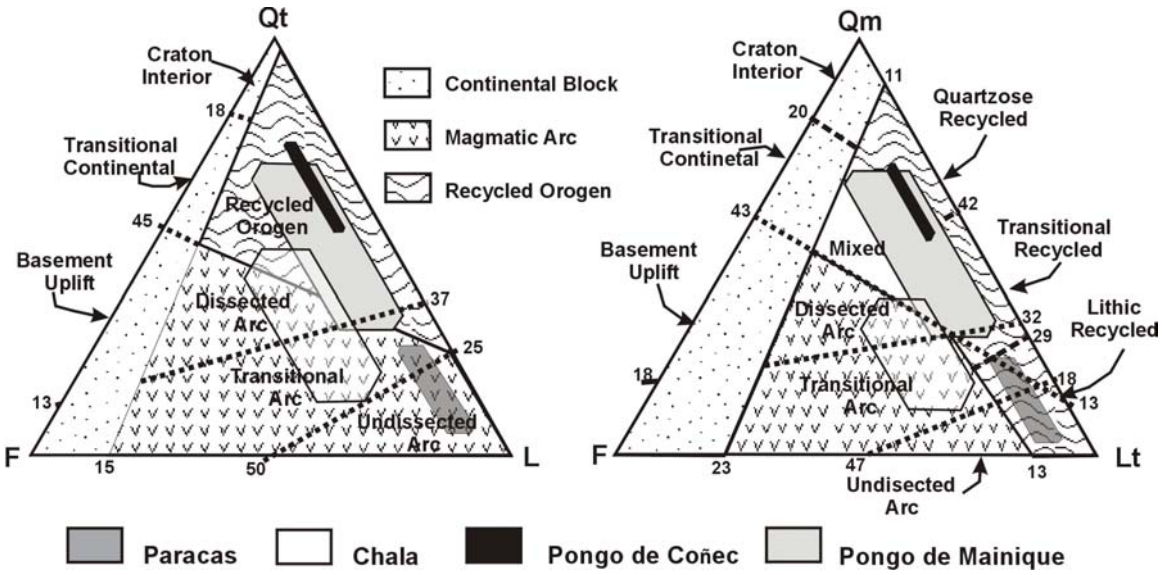
KEY WORDS: Western Gondwana, arc magmatism, petrofacies

INTRODUCTION

Late Paleozoic Magmatism along the Gondwana's Pacific margin has been documented from Antarctic to northern Chile (Mukasa and Dalziel, 2000, Ramos and Aleman, 200, Bell, 1987), to southern Peru as documented by the late Silurian to early Devonian San Nicolas Batholith. However, there is an apparent absence of radiometric ages to infer the persistence of this arc-trench system throughout the Carboniferous.

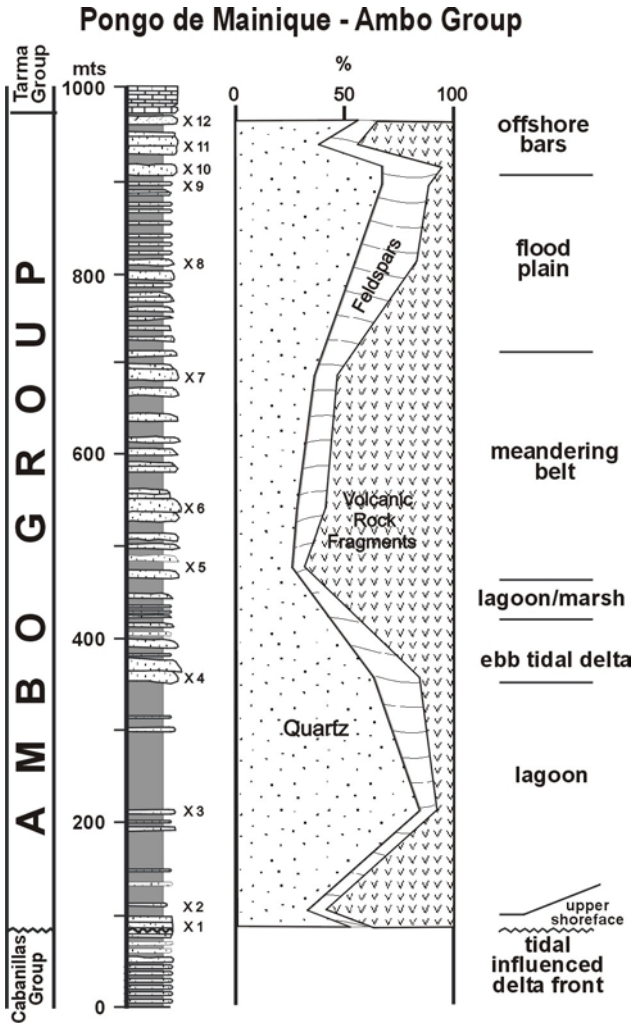
The Lower Carboniferous in southern Peru is represented by the Ambo Group (Newell et al, 1953), which consists of interbedded sandstones and shales with abundant coal seams. The only direct evidence of Carboniferous igneous activity is in the Shira Mountains where Megard (1978) and Dalmayrac and others, (1980) reported interbedded andesitic to rhyolitic lavas and tuffs; however, there is little comprehension about the nature and tectonic setting of this volcanic activity in eastern Peru. Recently, indirect evidence of volcanic activity has been reported from petrofacies studies in the northern Bolivian Altiplano (Diaz Martinez, 1995). He documented significant percentage of volcanic rock fragments in the uppermost unit of the Ambo Group.

Four sections of the Ambo Group in southern Peru have been studied using Dickinson's (1983) discrimination triangles. The Paracas peninsula section plots on the undissected to transitional arc ($Qt_{15}F_9L_{76}$ and Qm13F9Lt78), however, southward, the Chala section plots in a more mature transitional to dissected arc ($Qt_{31}F_{26}L_{43}$ and $Qm_{24}F_{26}Lt_{50}$). In this section the Ambo group contains thinly bedded tuffs are interpreted to suggest the presence of a contemporaneous volcanic arc rather than the erosion of an older arc massif. Although the arc-derived debris is more abundant along the coast, near the Carboniferous forearc and interarc basins, the influence of the magmatic arc also reached the retroarc basins such as documented in the Pongo de Mainique ($Q_{50}F_{13}L_{37}$ and $Qm_{48}F_{13}Lt_{39}$) and Coñec ($Q_{64}F_9L_{27}$ and $Qm_{61}F_9L_{30}$) in the Ucayali and Madre de Dios basins respectively.



Along the coastal sections, the abundance of coal seams and low Q/F ratio (1.2 to 1.7) is interpreted to represent a warm and humid climate supporting the interpretation from the fossil flora. This climate may account for the relatively poorly preserved volcanic rock fragments and partially altered feldspars to chlorite and sericite. Variable, but relatively high feldspar content and high Lv/Lt supports a magmatic arc provenance with significant arc dissection, and episodic unroofing of batholith roots. Eastward, the Q/F ratio significantly increases in the Pongo de Mainique (3.8) and Pongo de Coñec (7.4) and is interpreted to reflect the source from recycled transitional orogen and quartz rich lithologies. The vertical modal analysis at the Pongo de Mainique section indicates random variation controlled by the source area.

This petrologic evidence provides new lines of evidence to suggest the presence of an Upper Paleozoic arc-trench system in the western margin of Gondwanaland, which may have persisted since the late Silurian to early Devonian emplacement of the San Nicolas Batholith (Mukasa and Henry, 1990). This high K calc-alkaline magmatic arc developed during closing of the Lower Paleozoic extensional basin.



The already accreted Grenvillian Arequipa terrane was extended during the early Paleozoic ensialic and formed deep troughs where thick marine sequences interbedded with basic lava flows and sills were deposited. This facies are well documented in Bolivia and northern Argentina. Closing of this lower Paleozoic basin took place by collision and re-welding of the extended Arequipa terrane and was earlier in the south (Ocloyic Orogeny) than in the north (late Silurian to early Devonian Atico event of Shackleton and others, 1979). This event was coeval with the emplacement of the San Nicolas Batholith (Mukasa and Henry, 1990). An arc-trench system continued throughout the Carboniferous with different kinematics and subduction angle. Low angle subduction may account for a volcanic lull during the Carboniferous; however, the late Permian has been ascribed to insipient back-arc extension (Megard, 1978).

CONCLUSIONS

From Antarctica to southern Peru, the Gondwana's Pacific margin underwent a prolonged subduction-related magmatism at least since the early Devonian, which persisted through Carboniferous. The San Nicolas Batholith, formed during the closing of the early Paleozoic extensional basins, supports late Silurian to early Devonian magmatism. Petrofacies and the occurrence of thinly bedded tuffs in the Ambo Group suggest the presence of an arc-trench system along southern Peru during the Carboniferous. The lack of direct evidence for an arc may be related to a low angle subduction similar to the present day Peruvian margin. Regional analysis seems to support the presence of an arc-trench system in southern Peru at least since early Devonian.

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