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Geochemistry of sedimentary rocks from the Progreso and Tumbes Basins: an approach to provenance and geodynamic evolution

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We present here a geochemical approach to study the stratigraphic evolution of the onshore forearcs of SW Ecuador and NW Peru in the wake of a source-to-sink system.

This work considers 35 samples from the Cenozoic sedimentary infill (20 samples from the Progreso basin and 15 samples from the Tumbes basin). We assumed that collected samples represent the composition of each geological unit. Additionally, we compiled â‰ˆ245 analysis of possible rock sources, in order to compare the sediment (sink) with the origin (source). The main analyzed eventual sources surround the studied area are located in the Amotapes Cordillera (Jurassic metamorphosed mafic rocks, Triassic intrusive rocks and Paleozoic metamorphic rock), the Chongón-Colonche Cordillera (Cretaceous mafic igneous rocks) and the Occidental Cordillera (Cenozoic island and continental volcanic arcs). Major and trace element geochemistry reflect an alternation between mafic and felsic sources. The sampled sediments corresponding to eroded relict combined with continuous input since the contemporary volcanic arcs. We did not observed major signals of diagenetic process. Only two samples are conditioned with their geographical location, the sample CZ-009 collected in the Plateritos formation in the Tumbes basin shows a felsic signature, on the other hand the sample CP-101 of El Consuelo formation of the Progreso basin presents a mafic signature. Both examples were deposited very close to the protolith and represent end members for the felsic – mafic signatures. Sedimentary rocks with a clear felsic signature are Azúcar (Progreso basin) and Salinas, Plateritos, Heath (Tumbes basin). A minor felsic feature is observed in Guayaquil, Las Masas, Socorro, Seca, Punta Ancon, Zapotal, Dos Bocas, Subibaja, Progreso (Progreso basin) and Zorritos, Cardalitos (Tumbes basin), this aspect can be interpreted such as a mixture of protholits or the influence of a volcanic arc input. The ratio LaN/LuN (N=chondrite-normalized) is organized according to the stratigraphy and shows that values < 5 (minimum values = 1.17) are related with a provenance from mafic rock, values >5 (maximum values = 9.26) are associated to felsic rocks.

All samples show Nb negatives anomalies (c.f. mantle-normalized patterns). This suggests that volcanic arcs have been permanently contributing to the sedimentary infill of the forearc. The chondrite-normalized patterns display a fractionation model similar to felsic rocks, indicating that the supply from continental rock was always significant. One of the main contributions of this work is related with the felsic signature of the samples of the deep-water Guayaquil formation (K/T boundary); this formation has been previously associated with an allochthonous oceanic terrene. This geochemical signature may suggest that: 1) the allochthonous block must have a position close enough to the continental margin to receive such a continental input or 2) intermediate subduction-related rocks observed to the north of Guayaquil (Pascuales area) and attributed to the Las Orquideas Fm. represented a source at the moment of sedimentation of the Guayaquil Fm.