Geophysical Research Abstracts
Vol. 13, EGU2011-4775, 2011
EGU General Assembly 2011

New geochronological constraints on the Late Paleozoic to Jurassic of coastal southern Peru

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To further constrain the Phanerozoic tectonic and geodynamic evolution of the south Peruvian margin between 15° and 18°S, we here present an integrated field-geological and geochronological study providing evidence for several periods of continental margin arc volcanism during the late Paleozoic to Jurassic. A laser ablation ICP-MS study was carried out on detrital zircon from sandstones in the Peruvian Coastal Cordillera, complemented by analyses of Hf isotopic composition of detrital zircons and bulk rock geochemical analyses from associated mafic volcanics. Six key sections represent Grenvillian basement intruded by Ordovician plutons, on which a sedimentary cover was emplaced, ranging in age from Devonian to late Jurassic. Sediments of this age are mostly preserved in discontinuous outcrops overlying the basement. Two sections however record a continuous sedimentary section from Triassic deltaic to alluvial fan deposits into a Jurassic volcano-clastic sedimentary succession deposited in marginal extensional basins.

Because long-term magmatism in a single location can lead to complex resetting of K–Ar and Ar-Ar geochronological systems, we base this study on the premise that U–Pb zircon dating is the most robust basis for establishing a reliable chronological framework. The new data characterize two periods of volcanism along the southern Peruvian margin, a younger pulse between 185 – 160 Ma with a clear calc-alkaline signature, and an older pulse in the late Triassic (220- 200 Ma), contemporaneous with the breakup of Pangea, which can be traced along the whole South American margin. Sparse older detrital zircons were found ranging in age from 250 – 230 Ma. This early Triassic signature is more strongly represented towards the south of the study area. Further findings support the existence of known arc magmatic events during Ordovician to Devonian and Carboniferous. Reworking of the local basement is reflected by the presence of Grenvillian / Sunsás zircons in the sandstones of the sedimentary cover. Our hafnium isotope study on Triassic and Jurassic detrital zircons corroborates recent work by Reimann et al., (2010) showing that the crustal evolution of the western Gondwana margin (14°–17°) from 0.9 Ga onwards was dominated by crustal recycling.

References

Reimann, C.R., et al., Geodynamic evolution of the early Paleozoic Western Gondwana margin 14°–17°S reflected by the detritus of the Devonian and Ordovician basins of southern Peru and northern Bolivia, Gondwana Res. (2010), doi:10.1016/j.gr.2010.02.002