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Constraining the age of the Mitu Group, South-East Peru: U-Pb ages of detrital and igneous zircons

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Inverted extensional basins with continental deposits of the Mitu Group straddle the Eastern Cordillera of Peru. The present study investigates the Mitu Group of south-east Peru (13-16°S), which consists of continental clastic sedimentary rocks and interbedded basaltic to andesitic lavas. There is a paucity of geochemical and geochronological data from the Mitu Group, and the interpretation of its evolution is complicated by i) rapid changes in fault structure along-strike of the graben system, and ii) inversion during Andean orogenesis. Due to dominating coarse-grained clastics, the Mitu Group is devoid of fossils and its age is poorly bracketed to the Permo-Triassic, based on its stratigraphic relationships with the underlying Copacabana and overlying Pucará groups. The upper strata of the Copacabana Group have been constrained by palynology to the Artinskian, while marine fossils at the base of the Pucará Group indicate a Norian age. The Pucará Group is only present in northern Peru, whereas the Mitu Group has an erosional contact with overlying Cretaceous sandstones in the study area. Preliminary data suggest that the lower Mitu Group is middle Triassic, leaving a significant hiatus between the Copacabana and Mitu groups.

Laser ablation ICP-MS U-Pb zircon dating was utilized to characterize pre- and syn-rift detrital zircon assemblages in sandstones, as well as to date the syn-rift volcanic and plutonic activity.
Detrital zircon U-Pb age histograms of medium grained sandstones in the pre-rift Ambo and Copacabana groups contain several age populations, which can be immediately linked to major events identified along the western Gondwanan margin, such as the Sunsas/Grenville (1 Ga) and Pampean (0.55 Ga) orogenies, as well as the Famatinian arc (0.45 Ga). The youngest zircon in the population assigns a maximum deposition age to the rock; these zircons are of late Mississippian age for the Ambo and latest Pennsylvanian for the Copacabana groups. The Carboniferous zircons were most likely derived from a volcanic arc that was active at the time of deposition. On the other hand, the detrital zircon spectrum of a syn-extensional sandstone of the Mitu Group near the city of Abancay (13.6°S; 72.9°W) is heavily dominated by only one population. This Triassic population (69% of zircons) has a youngest zircon cluster of 225 Ma, which we consider to approximate the sedimentation age. The presence of one dominant population is explained by erosion of zircon deprived material at the rift shoulders, combined with hindered sediment input from across the shoulders. Thus, the Triassic detrital zircons were probably derived from syn-rift volcanism. This is confirmed by a U-Pb age of 234 Ma for zircons of a rhyolitic lava at the base of the Mitu Group, located close to the city of Sicuani (14.3°S; 71.2°W), further constraining the timing of the onset of extension. A rhyolitic tuff with poor stratigraphic control was dated at 226±10 Ma in the same area (Miskovic et al., 2009). Consequently, the data suggest that Mitu extension started in the middle Triassic, and not in the Permian, as previously assumed.
The Cordillera de Carabaya, which hosts a band of plutons, trends parallel to exposures of the Mitu Group, towards the north-east. Recent U-Pb zircon LA-ICP-MS and ID-TIMS data acquired from these granitoids shows that their ages range from middle to upper Triassic and hence overlap in age with the Mitu Group. We therefore conclude that the Cordillera de Carabaya granitoids represent crustal melting associated with Triassic extension.

Miskovic et al., 2009. Bull. Geol. Soc. Am. 121, 1298-1324