Geophysical Research Abstracts
Vol. 13, EGU2011-11755-1, 2011
EGU General Assembly 2011

Paleogeography of an Ancient Deep-Marine Foreland Basin, Upper Cretaceous Cerro Toro Formation, Magallanes Basin - Insights from U/Pb Geochronology and Strontium Isotope Stratigraphy

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Large axial submarine channels are a common morphologic feature on the seafloor of narrow elongate ocean basins in various tectonic settings, including marine foreland basins, subduction trenches, and marine rift basins. However, the detailed channel development and sediment-filling pattern of these trough-like deep-marine basins is poorly understood. The Magallanes foreland basin in Chile is an excellent location to study these systems. Isolated conglomeratic paleochannel fill preserved within the Upper Cretaceous Cerro Toro Formation was interpreted previously to represent parts of a single 4-8 km wide and > 100 km long submarine channel that funneled coarse-grained detritus southward along the axis of the foreland basin. This interpretation was based solely upon lithologic correlations made without the benefit of reliable depositional age constraints. New U/Pb dating of zircons from volcanic ashes and sandstones coupled with strontium isotope stratigraphy based upon calcite inoceramid shells helps to refine the controls on depositional ages and sediment provenance. Our results show that the conglomerates of the major axial trunk channel at three outcrop locations are $\sim$ 84-82 Ma in age and are contemporaneous within the limits of error. This supports the interpretation that the now isolated Cerro Toro conglomerates represent parts of a large axial channel belt. Channel deposits 20 km west of the axial trunk channel location represent a time span of $\sim$ 87-82 Ma. These channels are partly contemporaneous with the ones at the axial channel belt location, making it likely that they represent feeders to the main axial belt and do not represent axial channels developed earlier in the history of the foreland basin.
The Cerro Toro Formation spans a Turonian to late Campanian interval from $\sim$ 90-82 Ma in the northern Magallanes foreland basin. The top of the Cerro Toro Formation 70 km to the south is as young as $\sim$ 76 Ma. These ages suggest that parts of the Cerro Toro and the overlying Tres Pasos formations were deposited contemporaneously. Kolmogorov-Smirnoff (K-S) statistical analysis on detrital zircon age distributions shows that the northern uppermost Cerro Toro Formation yields a statistically different age distribution than six other detrital zircon samples collected from the same formation. However, this uppermost northern Cerro Toro sample shows no statistically significant difference relative to the overlying Tres Pasos Formation. This supports that the Cerro Toro and Tres Pasos formations are at least partly coeval. Integration of previously acquired geochronologic and stratigraphic data with the new geochronologic constraints suggest a southward progradational pattern in all four Upper Cretaceous marine formations in the Magallanes Basin, producing a pronounced southward younging of all the marine formations. Highly diachronous infilling may be an important depositional pattern for narrow, elongate, orogen-parallel ocean basins.