The Patagonian Orocline

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Résumé

The southernmost Andes of Patagonia and Tierra del Fuego present a prominent arc-shaped structure: the Patagonian Bend. Few paleomagnetic studies have been attempted to describe the rotations associated with the formation of the curvature. Whether the bending is a primary curvature or a "true" orocline is still matter of controversy. New paleomagnetic data from sixty-one sites drilled in the outer part of the orogen from 54◦ S to Peninsula Hardy (_˜55◦ S), south of the Beagle Channel allow the quantification of tectonic rotations in the area. Twelve sites were drilled in Early Cretaceous sedimentary and interbedded volcanic rocks of the Yahgan and Hardy formations, 3 sites were drilled in pseudo-ophiolitic complexes and forty-six sites were sampled in Cretaceous to Early Eocene plutonic rocks. Characteristic Remanent Magnetizations (ChRMs) were determined after stepwise alternating field or thermal demagnetization. Anisotropy of magnetic susceptibility were systematically measured at all sites.

Sedimentary and interbedded volcanic have normal polarity paleomagnetic directions and their characteristic directions failed the fold test. Sedimentary sites closer to the Beagle Channel and the Cordillera Darwin metamorphic core present a well-defined magnetic foliation (degree of anisotropy between _˜1.2 and _˜1.5) parallel to the tectonic foliation. Sites far from the Beagle Channel have low magnetic anisotropy (anisotropy $<$ 1.1) but a foliation due to tectonics can also be recognized. Mid Cretaceous plutons intruding the sedimentary rocks have a magnetic fabric related to the late stages of pluton emplacement. The remagnetized rocks have ChRMs directions of normal polarity with west oriented declination. We suggest that the remagnetization was acquired during the long normal Cretaceous superchron likely in relation with deformation and magmatic activity in the region. Such a remagnetization event was also recognized in the Antarctic Peninsula (Poblete et al., 2011). The remagnetization indicate a counterclockwise rotation of 94.8±16.9◦ in Peninsula Hardy. This counterclockwise rotation is also found in a mid Cretaceous pluton within Navarino Island at Dientes de Navarino.

Characteristics Remanent Magnetizations from sites in the South Patagonian Batholith sampled from the south Arm of the Beagle Channel, Canal O'Brien, Canal Ballenero and Peninsula Brecknock to the west, correspond to a primary magnetization recorded during pluton

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emplacement. Normal and reverse polarity magnetizations are found in antipodal distribution. The distribution of the paleomagnetic results do not show evidence for significant deformation in the study area and the deviations of the declinations with respect to the ones expected for stable South America are best explained in term of counterclockwise rotations. Mid-Cretaceous intrusive rocks record counterclockwise rotations of about 90◦ while only 20◦ of counterclockwise rotation is recorded in Eocene intrusive rocks.

Large sinistral strike slip deformation has often been advocated for the tectonic evolution of southern Patagonia. The good agreement between the counterclockwise rotation recorded in remagnetized sediments and mid Cretaceous plutons and the decreasing magnitude of counterclockwise rotation from Cretaceous to Eocene suggest that the rotation pattern is best explained by large block rotations. Counterclockwise rotations are related to the closure of the Rocas Verdes basin during the Late Cretaceous. Using the Gplates software, we made tectonic reconstructions that clearly demonstrate the importance of the collision of the Antarctic Peninsula with the Southern Patagonia in the development of the Austral Andes during the Late Cretaceous and Early Cenozoic.

The tectonic evolution of the Patagonian bend can thus be described as the formation of a progressive arc from an oroclinal stage during the closure of the Rocas Verdes basin to a mainly primary arc during the final stages of deformation of the Magallanes FTB (Poblete et al., 2014).

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