# PALAEOMAGNETIC STUDIES OF FAULT BLOCK ROTATIONS IN RELATION TO TRANSTENSION ON THE ATACAMA FAULT SYSTEM AND GRANITE EMPLACEMENT

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RESUMEN :

Los resultados palaeomagntic de rocas del Formación La Negra de la Cordillera de la Costa, entre 26° y 27° S, presenta dirección rotaciones horarias 35°. Esta rotacion son probalemente un resultado de moveimientos rotacionales in situ de bloque, esta resultado rotacion compuesta Juarsico y Cretacico.

KEY WORDS : Palaeomagnetism Jurassic Rotation Atacama Chile

## INTRODUCTION

Palaeomagnetic studies of Jurassic and Cretaceous volcanic, sedimentary and intrusive units of the Coastal Cordillera of northern Chile have revealed the widespread occurrence of clockwise crustal block rotation. In contrast to this similar aged units in northernmost Chile, southern Peru and Bolivia have undergone anticlockwise rotation. These rotations have been viewed as being complimentary to one another and interpreted in terms of oroclinal bending (Kono et al., 1985), differential shortening across the arc induced by the pre-existing shape of the Pacific margin of South America (Isacks, 1988) or systematic regional shear of the forearc region (e.g. Beck, 1988). Fundamental to these models is the kinematic control of strike-slip fault systems on fault block rotation. This study aims to integrate the palaeomagnetic determination of the magnitude of fault block rotations with the detailed structural analysis of the kinematics of the block bounding faults in relation to transtension on the Atacama Fault System and the emplacement of plutonic complexes within the arc.

## GEOLOGICAL SETTING

The area studied lies between 26 and 27° S and to the east of the Upper Palaeozoic Chañaral Melange (Bell 1987) and is bounded by the El Salado segment of the Atacama Fault System. The structurally highest unit is the Le Negra Formation thought to be of Upper Sinemurian to Lower Bajocian or Kimmeridgean in age and which is underlain by the Pan de Azucar formation of Hettangian-Sinemurian age (Naranjo 1978). These are separated from the basement and cut by, brittle, listric, left normal faults linked to the sinistral strike-slip faults of the Atacama Fault System. These units are intruded by Jurassic (c. 153 Ma) and Cretaceous (c. 127 Ma) wedge shaped plutons which are elongate parallel to the arc and young systematically to the east. These plutons are in turn cut by a series of dyke swarms which account for up to a further 15% East-West dilation of the area and which also systematically young to the east.

Over 80 palaeomagnetic sampling sites have been collected from the andesitic flows, tuffs and sandstones of the Le Negra formation and from dyke swarms which have yielded reliable Ar-Ar ages of 154Ma and 126Ma which intrude the plutons and from an undated, as of yet, but apparently younger third swarm which cuts the fault system itself. A total of 12 sites from the Le Negra formation have currently been studied. These yield a characteristic remanence which passes both a reversal and fold test which coupled with the remanence being found in a variety of lithologies clearly indicates the primary nature of the remanence. The mean direction (declination = 47.2, inclination -41.3, $k = 15.0$, $\alpha 95 = 4.2$ from 43 samples) indicates that the area has suffered a clockwise rotation of some 35° but no latitudinal transport, which is consistent with previous results from the Coastal Cordillera. At least part of this rotation is believed to be linked to and contemporaneous with the emplacement of the wedge shaped plutons., in particular the Cretaceous, 127 Ma, Las Tazas pluton whose outcrop and structure indicate that some 15-20° rotation of the area took place at this time.

## CONCLUSIONS

The Le Negra formation exhibits a primary Jurassic palaeomagnetic remanence which indicates a net local block rotation of some 35°. At this time it is believed that this rotation is compound and comprises at least two separate age components. The palaeomagnetic analysis of the dated dyke swarms will reveal the timing and extent of rotation associated with the evolution of the fault system itself and will help to differentiate between progressive and punctuated fault block rotation. The study as a whole will better constrain the kinematic evolution of the arc itself and delineate the effects of back-arc basin development.

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