THE SOUTH-WESTERN MEJILLONES PENINSULA. BASEMENT TERRANE OR DEFORMED HIGH LEVEL MAGMA CHAMBER?

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RESUMEN: La parte suroeste de la Peninsula de Mejillones, la que està ubicada al noroeste de Antofagasta en el norte de Chile se ha considerado componerse de gneises atribuìdo al basamento cristalino. Ahora es possible para entender estas rocas como los productos de una recàmara de magma de nivel alto.

KEY WORDS: Chile, Mejillones Peninsula, acid/basic relationships.

INTRODUCTION

The Peninsula de Mejillones is located in Northern Chile (23° - 23° 30' S), immediately to the north west of Antofagasta (Fig. 1). The southwestern part of the peninsula is composed of a suite of deformed gabbroic to dioritic rocks, which are extensively intruded by sheets and veins of acidic and tonalitic composition, as well as basic dykes. These rocks have previously been regarded as basement gneisses (Venegas Carvajal 1979) and have been assigned ages ranging from Palaeozoic (Ferraris and Di Biase 1978) to Pre-Cambrian.(Skarmeta and Suarez 1979; Vengas Carvajal 1979).

FIELD RELATIONS

Recent field work has led to a reinterpretation of these rocks as the remnants of a deformed mid to upper crustal magma chamber. Field observations suggest strongly that the foliated nature of the complex developed from syn-to-post magmatic deformation of co-existing intermediate and acid melts. Evidence for magma mingling include early mafic to intermediate dykes, sheets, and pillows exhibiting crenulate and cauliform margins typical of fluid-fluid contacts. Microdioritic enclaves are abundant, and often show signs of chilling (grain size reduction) at their margins.Texturally the rocks are extremely variable with the dioritic facies showing extensive interaction on all scales with the invading acid melt. In addition to obvious liquid-liquid contacts between veins and host rock, there is local evidence on an outcrop scale of thorough magma mixing, producing a melanogranite/leucodiorite rock. Coarse appinitic pods with skeletal amphibole and plagioclase are also present, suggesting the presence locally of rapid quenching of water rich magmas. These observations are consistant with those reported from well documented examples of mid to upper crustal mixed and magma mingled complexes from the Channel Islands and the Coastal Batholith of Peru (D'Lemos 1993; Bussell 1992).

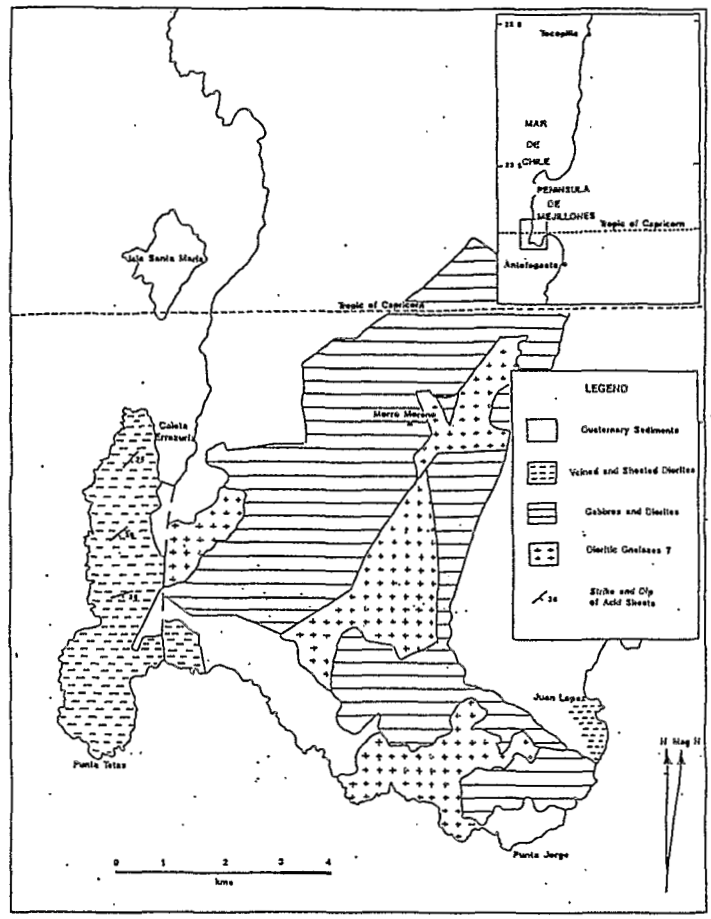

FIG. 1 Simplified Geological Sketch-map of the Southern Mejillones Peninsula, Region 2, Chile
(Modified after Venegas Carvajal 1979)

A pervasive foliation occurs throughout all but the very latest intrusions, although its intensity is variable from place to place, often being concentrated in local intense shear zones. It is however, usually continuous through the host diorites into the invading veins with no apparent change in orientation from one rock type to the other. A later foliation is locally present which cross cuts the earlier one at a high angle, but it is only poorly developed.

The sheeting and veining in the study area is complex. There are several types of veins, including garnetiferous leucogranites, acid pegmatites, aplites, and tonalites, as well as veins of pure quartz. In addition, the geometry of the veins and sheets is very variable. Contacts between the veins and the host rock frequently change in character, from fluid-fluid type contacts to seemingly brittle contacts, along the length of the vein. This is interpreted as being due to variations in the rheological properties of the fluids with varying strain rates, in combination with local variations in the crystal:melt ratio. The most significant intrusions volumetrically are the garnetiferous granites and aplites, which comprise approximately 15% of the entire rock mass of the outcrop. They occur as sheets ranging in thickness from 30 cms to 60 cms, and exhibit an obvious preferred orientation, typically striking at around 160-240° with an average dip of 30° SE.(Fig. 2). A multitude of smaller veins occur, though these appear to have a more random orientation.

Basic dykes have been intruded into the complex, both during, and after deformation. Syntectonic dykes show evidence of shearing, and exhibit the same foliation as the host rocks.

Mechanical interaction between these dykes and the host diorites has led to the formation of basic enclaves. Completely undeformed dykes are also present, which have clearly been intruded into a solid host after deformation had ceased. Typical orientations of the basic dykes are shown on Fig. 2.

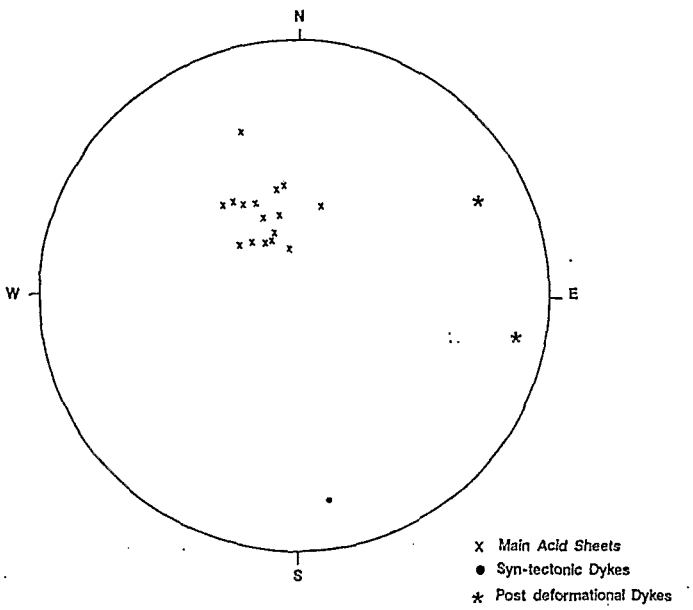

FIG. 2 Stereonet Showing Orientations of Acid Sheets and Basic Dykes

DISCUSSION

On the basis of field relationships it is suggested that the rocks of the southwestern Mejillones Peninsula are the products of a mid to high level magma chamber, and not lower crustal basement migmatites as previously thought. Given this new interpretation, it is possible that these rocks may be 'Andean' and thus of an age significantly younger than previously supposed. These ideas are currently being tested using a combination of radiometric age dating and mineral chemistry.

REFERENCES

D'Lemos, R.S. 1992, Magma-mingling and melt modification between granitic pipes and host diorite, Guernsey, Channel Islands. J.Geolsoc.London. 149, 709-720.

Ferrari, F.& DiBiase,F 1978, Carta Geologica de Chile, Hoja Antofagasta.Instituto de Investigaciones Geologicas No.30

Skarmeta, J.& Suarez, M., 1979 Complejo Granitico - Gabroico Milonitizado de la Peninsula de Mejillones: Nota Preliminar, Segundo Congreso Geologico Chileno

Venegas Carvajal, R. 1979 Rocas Metamorficas y Plutonicas de la Peninsula de Mejillones al Sur de los 23°17' Lat.Sur, y al Oeste de los 70°30' Long, Oeste II Region-Chile Segundo Congreso Geologico Chileno