



A PROGRESS REPORT ON THE EMPLACEMENT MECHANISM OF THE NAHUEL BUTA PLUTON BASED ON THE ANISOTROPY OF THE MAGNETIC SUSCEPTIBILITY AND MICROSTRUCTURES

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ABSTRACT

The anisotropy of the magnetic susceptibility (AMS) in a low magnetic field under laboratory conditions was determined for the Nahuelbuta Pluton, which makes part of the Coastal Batholith (Southern Chile) that intruded the Eastern Series of the basement of the Coastal Cordillera. From the bulk value for the magnetic susceptibility it is indicated that all the igneous rocks are dia- and paramagnetic. The foliations have N-S strike. The inclination of the foliation is vertical at the borders to moderately inclined in the centre of the pluton. The lineation is subhorizontal. The shape of the anisotropy is oblate and the corrected degree of anisotropy is less than 1.052. A suggested model for the fabrics is an N-S oriented fault in a compressive tectonic setting that was responsible for the pluton emplacement. But this still has to be confirmed by additional AMS data and the structures of the rocks.

Key words: Chile, Basement of the Coastal Cordillera, Magnetic fabrics, Microfabrics, Magma ascent

RESUMEN

Se determinó la anisotropía de susceptibilidad magnética (ASM) para el Plutón Nahuelbuta en un campo magnético bajo en condiciones de laboratorio. El Plutón Nahuelbuta, que es parte del Batolito de la Costa del sur de Chile, intruyó la Serie Occidental del basamento de la Cordillera de la Costa. A partir del valor *bulk* para la susceptibilidad magnética se indica que todas las rocas ígneas son día- y paramagnéticas. Las foliaciones tienen un rumbo N-S. La inclinación de la foliación es vertical en las bordes, a moderadamente inclinadas en el centro del plutón. La lineación es subhorizontal. La forma de la anisotropía es oblada y el grado corregido de anisotropía es menor que 1.052. El modelo sugerido para las fábricas sería una falla con orientación N-S en un ambiente tectónico compresivo que fue el responsable del emplazamiento del plutón. Pero esto aún tiene que ser confirmado por los datos de ASM adicionales y de las estructuras de la rocas.

Palabras clave: Chile, Bastamento de la Cordillera de la Costa, Fabrica magnética, Microfabrica, Magma ascenso

Introduction

The Nahuelbuta Pluton is part of the Coastal Batholith that extends from Valparaíso to the Lake Ranco (see fig. 1). The Nahuelbuta Pluton southward of Concepción was emplaced in the Upper Carboniferous at 308 ± 4 Ma during the Gondwanan tectonic cycle (Lucassen *et al.* 2004). It is a metaluminous intrusion that was formed due to a subduction setting of the Iapetus oceanic crust under the continental basement of the Coastal Cordillera. It was emplaced in the metamorphic Eastern Series, which comprises turbiditic graywackes and clays that were deposited in basins that have a Devonian to Carboniferous age based on fossils. The regional

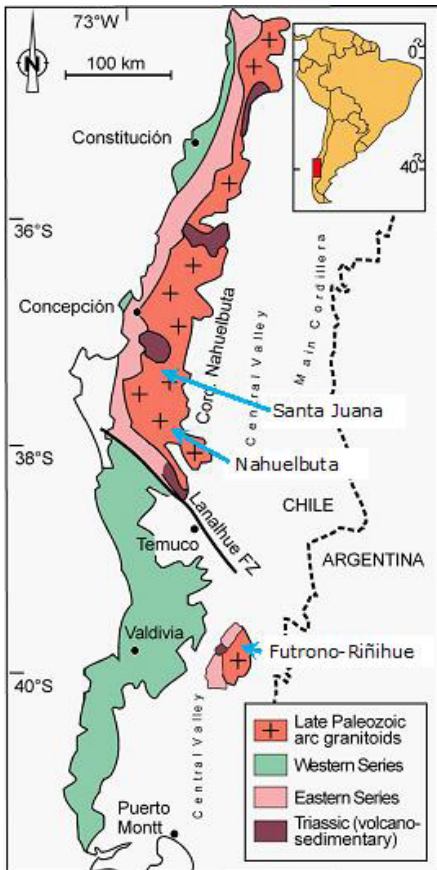


Figure 1. Geologic sketch map of South-Central Chile. Western (green) & Eastern Series (pink), late Palaeozoic granitoids - Santa Juana, Nahuelbuta & Futrono-Riñihue- (red), Triassic sediments (purple), Llanhue fault zone (Glodny *et al.* 2008).

metamorphism was in the range of 350°C and 3.5 kbars (Willner 2005). This regional metamorphism was overprinted by a contact metamorphism that yields a maximum temperature of 700° C at the intrusion contact. According to Parada *et al.* (2007) the pluton intruded into a compressional setting. Subsequently the Peruvian and Sub-Hercinian tectonic cycles, active during the Cretaceous, deformed the Nahuelbuta Pluton at temperatures that were below 300°C.

This contribution deals with the AMS technique and the microfabrics of the emplacement of the Nahuelbuta Pluton which can be used for the geodynamic model between the continental basement and the palaeo-Pacific plate.

Magnetic fabrics and microstructures

The anisotropy of the magnetic susceptibility was measured in order to get a value for the foliation and lineation and for the bulk susceptibility. We have measured two profiles that were oriented E-W. One profile is located between Curanilahue and Nacimiento and the other one, between Angol and Cañete. The values for the

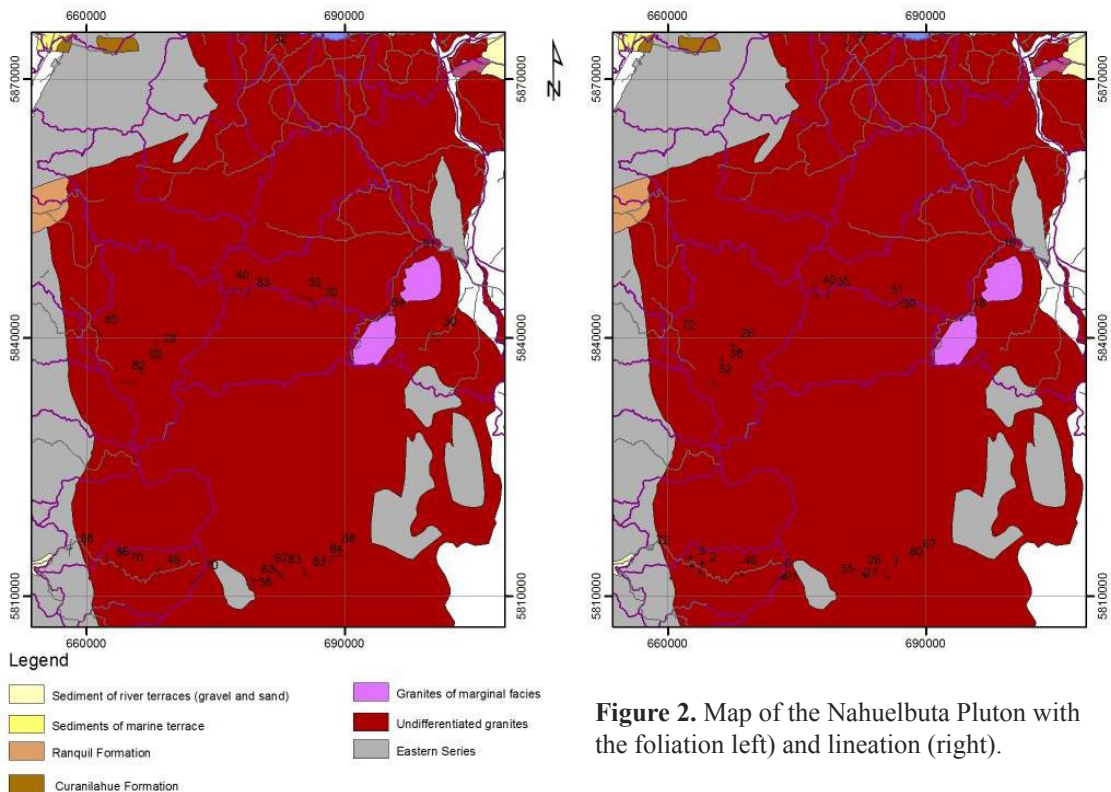
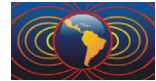


Figure 2. Map of the Nahuelbuta Pluton with the foliation (left) and lineation (right).



bulk susceptibility are in the range between 40.9×10^{-6} and 610×10^{-6} (SI) with a mean value of 266×10^{-6} . This indicates that the intrusion is composed of dia- and paramagnetic minerals with a minor amount of ferromagnetic (*s.l.*) minerals and that the values for the fabric are reliable. The directions of the foliation are N-S and moderately inclined to vertical in the central part of the pluton and vertical at the borders (fig. 2). The lineation is subhorizontal with a plunge either to the north or to the south. The microstructures for most of the samples are magmatic to submagmatic which might indicate that they were developed during the pluton emplacement. The samples that are deformed during sub-solidus to brittle conditions show different AMS values.

Results

These are only a few values for the magnetic fabrics of the Nahuelbuta Pluton but they are consistent with the idea of Kleiman and Japas (2009) who proposed a mylonitic fault system that was oriented N-S parallel to the palaeo-continental margin that was used for the ascent of the magma.

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