PRELIMINARY PALEOMAGNETIC RESULTS FROM THE PLEISTOCENE VILLARICA VOLCANO AND MIOCENE FARELLONES FORMATION

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INTRODUCTION

The Geomagnetic field can be described mainly as the field developed by a geocentric axial dipole and this property is at the core of successful applications of paleomagnetism to tectonics. The study of the spatial and temporal characteristics of the secular variation of the geomagnetic field is important to understand its origin. The uneven geographic distribution of paleomagnetic results with few available data in the southern hemisphere, however, impedes an accurate analysis of the fine-scale changes in the statistical characteristics of paleosecular variations [See Jacobs, 1994] .

The behavior of the earth magnetic field during polarity reversal has also been recently the subject of large debate on a possible confining of transitional field paths over specific longitudinal bands and it is interpreted as evidence for core-mantle interaction [Gubbins, 1994].

Although many paleomagnetic studies have been devoted to tectonics in Chile, they are few results directly available to describe secular variations and transitional behavior [Brown et al., 1994]. In december 1995, we started a project of paleomagnetic secular variations which includes the sampling of 21 sites in Pleistocene-Holocene lavas from the Villarica volcano and two sections (31 sites) of the Miocene Farellonnes volcanic formation. Such paleomagnetic studies are not only relevant to the geomagnetic field but they may also provide additional information on the timing of volcanic eruption or tectonic rotations.

The VILLARICA volcano

The Villarica is a Quaternary and active volcano at the latitude of 39°S. There is no available cross-section of the volcanic sequence. However, based on characteristic pyroclastic flows with radiocarbon ages, it is possible to assign a relative age to several of the lava flows that outcrop as small valley filling (Moreno in preparation). We have sampled 21 sites mostly in the post-glacial lavas. The secular variation appears relatively low and many sites record similar directions. Absolute paleointensities by the Thellier and Thellier method will bring additional information on secular variations. In the end we also hope that between-site correlation of paleomagnetic results might help constrain the timing of the volcanic activity.

The Miocene FARELLONES formation.

The Farellones formation is a middle Miocene volcanic formation with available K-Ar radiometric ages in the range 16-19 Ma (Beccar et al., 1986). Farellones volcanics outcrop along the road going to the ski resorts east of Santiago. We drilled 7 flows in a 150m section below the village of Farellones. The other sequence (24 sites) is a 450m thick section below the ski resort of Valle Nevado located about 10

Km east of the Farellones section. In our study area, the Farellones volcanic formation does not show evidence for a tectonic tilt or folding. The Farellones section is at a lower elevation than the Valle Nevado section and it is thus assumed to be older than the Valle Nevado section (Fig. 1).

The magnetic susceptibility is high for almost all sites except two (average 2.8 10^{-2} SI) in agreement with the andesitic nature of this volcanism (Beccar et al., 1986). After removal by thermal cleaning of a secondary overprint in the present-day field, characteristic directions were easily determined for most sites.

The Farellones section is only of normal polarity and two reversals are observed in the Valle Nevado section suggesting that the Farellonnes volcanism did not last more than 2 Ma. One precise Ar^{39}-^{40} radiometric age is however needed before to attempt a correlation with the reference geomagnetic reversal time-scale.

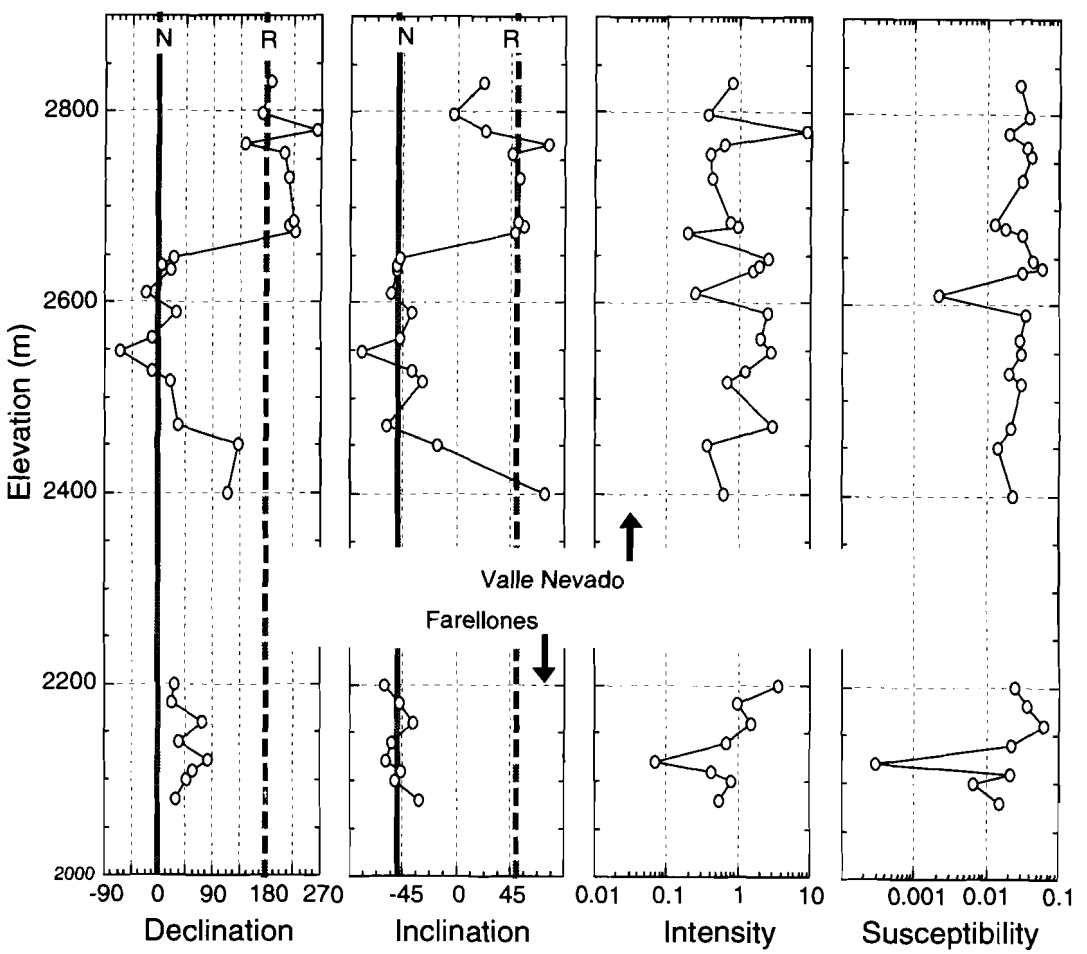

Figure 1: Paleomagnetic results from the Farellones - Valle Nevado volcanic sequence. The direction is the site-mean characteristic direction determined after stepwise thermal cleaning. Geometric site-mean values of the intensity of the natural remanent magnetization in Am^{-1}. Geometric site-mean values of the magnetic susceptibility in SI.

An other interesting observation is that the mean direction (Declination: 28° Inclination: -53.7°) is significantly different from the expected middle Miocene direction (357°, -57°). This preliminary result suggests that the Farellones-Valle Nevado area rotated clockwise since about 17 Ma. Clockwise rotations have also been reported by Beck et al. [1986, 1990] in areas located about 100 km north and south of Santiago. Further work is still needed to confirm this rotation and better understand the late Tertiary tectonics of the area.

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