

PALEOMAGNETISM OF THE MEDICILANDIA SILL FROM THE CENTRAL ATLANTIC MAGMATIC PROVINCE, AMAZON BASIN, BRAZIL

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ABSTRACT

The Penatecaua magmatism occurring in northern Brazil (Pará State) belongs to the so-called Central Atlantic Magmatic Province (CAMP), which preceded the Pangaea breakup. Near the city of Medicilândia, a large diabase sill outcrop along road cuts for nearly 50 km. Recent ⁴⁰Ar/³⁹Ar dating give an age of ~201 Ma for the CAMP magmatism in the area. The paleomagnetic study on 9 sampling sites of the Medicilândia sill, revealed stable characteristic magnetization components through alternating magnetic field and thermal demagnetizations. The main magnetic carriers are magnetite or low-Ti titanomagnetites. The paleomagnetic pole calculated for eight sites is coherent to other South American CAMP paleomagnetic poles for which good age control is available. However, this new pole differs from the existing pole for the Penatecaua dykes located to the northwest of the sill, and for which no reliable age exists so far.

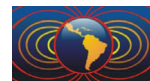
Keywords: Paleomagnetism, Penatecaua magmatism, Medicilândia sill, Central Atlantic Magmatic Province.

RESUMO

O magmatismo Penatecaua que ocorre no Estado do Pará faz parte da grande Província Magmática do Atlântico Central (CAMP), cuja formação precedeu a ruptura do Pangea. Próximo à cidade de Medicilândia, aflora uma grande soleira de diabásio e que pode ser observada ao longo de 50 km. Idade ⁴⁰Ar/³⁹Ar recentes atribuem a idade de ~201 Ma para o magmatismo CAMP nesta região. Estudo paleomagnético no sill de Medicilândia foi realizado em nove sítios de amostragem ao longo de toda a extensão maior do corpo. A magnetização remanente característica dos sítios estudados é de polaridade normal e foi identificada através de desmagnetizações por campos magnéticos alternados e desmagnetizações térmicas. Os portadores magnéticos são magnetitas ou titano-magnetitas com baixo conteúdo de Titânio. O polo paleomagnético calculado com base em oito sítios de amostragem é perfeitamente coerente com polos de outras ocorrências ígneas da América do Sul já identificadas como pertencentes ao evento CAMP, entretanto, difere do polo existente para os diques Penatecaua que ocorrem a noroeste da área estudada, para os quais ainda não se tem idade absoluta confiável.

Palavras-chave: Paleomagnetismo, magmatismo Penatecaua, sill de Medicilândia, Província Magmática do Atlântico Central.

The Medicilândia sill corresponds to the Penatecaua magmatism, related to the Central Atlantic magmatic province (CAMP) in north South America; the huge igneous province that preceded the Pangaea breakup. The CAMP ages vary from the end of Triassic to the beginning of Jurassic. High precision ⁴⁰Ar/³⁹Ar dating (Davies *et al.*, 2017) on the Penatecaua intrusive rocks (201.52 ± 0.07 Ma) placed this magmatism at the Triassic-Jurassic boundary (201.36 ± 0.17 Ma). So far, the CAMP activity was placed synchronous to the end-Triassic biotic crisis (Whiteside *et al.*, 2007) being discarded as the triggering mechanism. The new results place the Penatecaua low-Ti tholeiitic gabbros preceding the mass extinction event, and probably responsible for it. The trigger mechanism could be a climate change through the degassing of the sedimentary basement, which flooded the atmosphere with volatiles. The Penatecaua magmatism includes



sills and dykes bordering the Amazon River. The Medicilandia sill is a large body outcropping along ~50km of the BR230 road, and for nearly 15 km in the north-south direction. Although outcrops are not continuous, and are subjected to severe weathering conditions, it was possible to sample fresh rocks from eight sites for the paleomagnetic work.

After the AF cleaning up to 50mT, remanences were erased, and the characteristic magnetizations revealed (Fig. 2). After submitting samples to AF cleaning, at 15 mT to remove viscous components, the Thermal demagnetization completely erased remanence at about 580° C (Fig. 2). These results along with the thermomagnetic curves, hysteresis loops and isothermal remanent magnetization acquisition curves, point to magnetite or titanomagnetite with low-Ti content, as the main magnetic carrier, and to a primary magnetization component of thermal origin. Characteristic magnetizations for all studied sites are of normal polarity (Fig. 1). Some few anomalous directions may be related to rolled blocks or to a transitional field, and a future additional sampling will be necessary to confirm the last hypothesis.

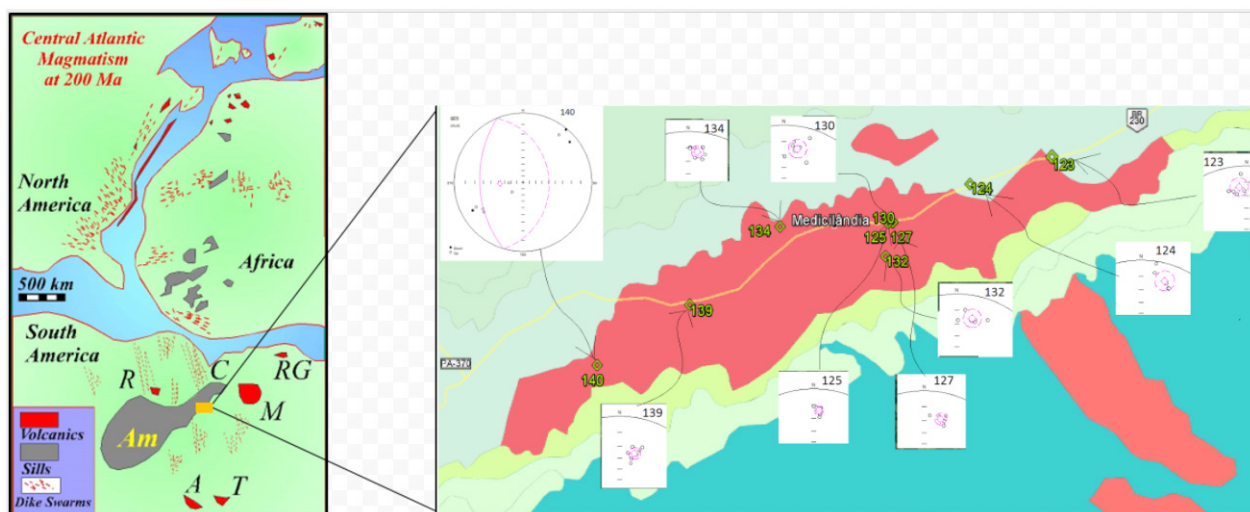


Figure 1. Sketch map of the CAMP occurrence (Marzoli *et al.*, 1999), and the sampling site location of the Medicilandia diabase (Costa *et al.*, 2012). The figure also shows the magnetization directions for each site obtained in this work.

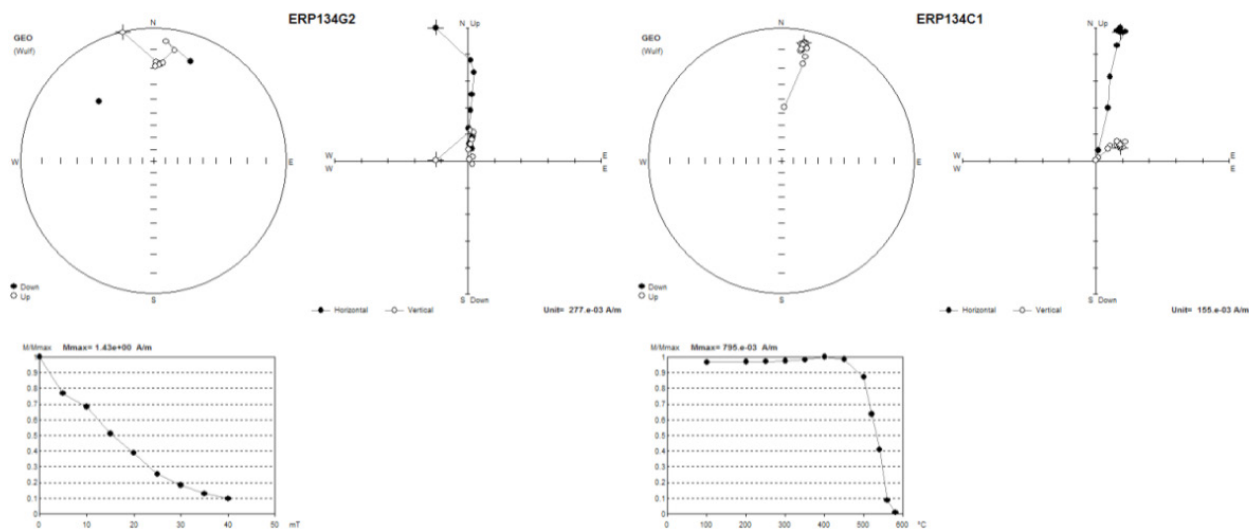
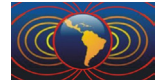


Figure 2. Examples plots of AF and thermal demagnetization for two samples of the Medicilandia sill.



The virtual geomagnetic poles (VGPs) that correspond to the mean direction of each site (Fig. 1) show less dispersion than the expected for the secular variation. Even though, Costa *et al.* (2012) recognized a zonation in the Medicilândia sill with more evolved facies located in the center of the body. The authors also recognize different types of rocks based on their TiO_2 content.

The mean of the eight VGPs from the Medicilândia sill resulted in a preliminary paleomagnetic pole, which is compared to others of similar ages compiled by Ernesto *et al.* (2003) for the Amazonian area (Fig. 3). In this Figure, only poles with good age control were included, however, the former work from Guerreiro and Schult (1986), on the Penatecaua dykes, located to the north of the Amazonas River, was included for comparison. The Medicilândia pole matches well the CAMP dykes from northern South America, but differs from the Penatecaua dykes and the Anari-Tapirapuã basalts. However, a significant tectonism seems to have affected the area to the North of the Amazon River (Figueira *et al.*, 2012) where the Penatecaua dykes are found; on the contrary, the Medicilândia sill seems to keep its paleohorizontal as the AMS ellipsoids are flat with the maximum susceptibility axes nearly horizontal. These issues will probably be elucidated, as new paleomagnetic data from other intrusive bodies will be incorporated to the analysis.

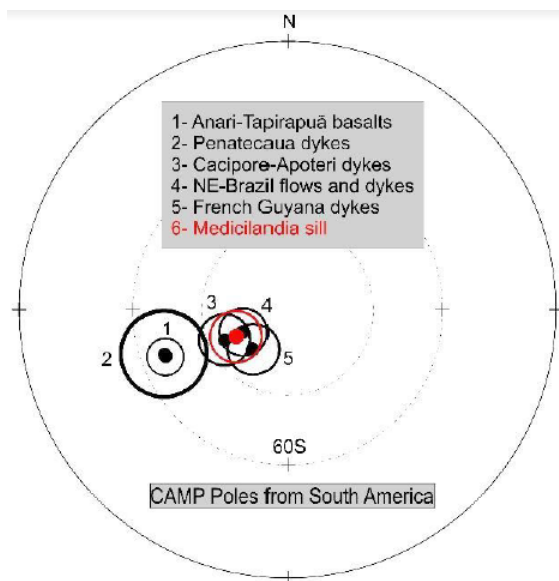


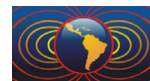
Figure 3. CAMP paleomagnetic poles from South America, and comparison with the Medicilândia sill pole.

Acknowledgments.

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