Upward and Horizontal Magma Flow Recorded By the Anisotropy of Magnetic Susceptibility of Tonalites from the Alto Maranhão Suite, Mineiro Belt

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The Mineiro Belt is an accretionary segment of the Archean to Paleoproterozoic São Francisco paleocontinent. Within its NE margin, the Jeceaba-Bom Sucesso (JBSZ) and the Congonhas-Itaverava (CISZ) shear zones separate the northern Archean to Paleoproterozoic metamorphic complexes and passive margin terrane from the southern Paleoproterozoic arc-related rock assemblages. The studied Alto Maranhão suite (2130Ma) is bounded by these shear zones and interpreted to have a structural control based on previous microstructural analysis and pluton shape. Field observations, microstructural analysis and magnetic fabrics were employed in order to constrain an emplacement model and tectonic implications for the evolution of this suite. Magnetic mineralogy experiments show that the origin of the magnetic susceptibility is due to the presence of paramagnetic mineral phases, in this case, biotite and hornblende. The bulk susceptibility varies from 63.5 to 541 μSI and is in agreement with paramagnetic tonalites worldwide. Shape ellipsoids (T) are mostly > 0 for the Western lobe (close to NE-SW JBSZ trend), and < 0 for the Eastern lobe of the pluton (nearby the NW-SE CISZ trend). Anisotropy degree (P), used as a strain parameter, does not exceed 1.095. The higher values occur mostly in the Eastern lobe to the intermediate zone. The range of P matches with the anisotropy found on textural differences for plagioclase (mostly shape and elongation). The magnetic foliation is mainly parallel to the field magmatic foliation, aligned parallel to the adjacent shear zones, and deeps steeply to moderately to SE and SW, in the western and in the intermediate to the eastern lobe, respectively. Contacts with the host rocks are not observed, but the tectonic foliation matches the magmatic and magnetic structures. Magnetic lineation is subvertical and NW-SE trending in the eastern lobe and in the central, intermediate zone, changing into horizontal with random orientations towards the western lobe. These structural observations suggest that the eastern lobe may be characterized as a feeder zone in which magma ascended assisted by active pre- to syn-shear deformation of the CISZ. The magma flow gradually changed into a horizontal disorganized flow, promoted by a large crustal discontinuity as the JBSZ, favoring lateral spreading of the magma. Finally, the relationship of these shear zones with the emplacement of the Alto Maranhão suite suggests active transcurrent deformation taking place simultaneously with the orogeny that build up the São Francisco Paleocontinent.