

Rock-magnetism, microscopy and quantitative magnetic interpretation of Las Truchas iron-ore mining district, Michoacan, Mexico

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Abstract: Iron ore and host rocks have been sampled (90 oriented samples from 19 sites, and 56 non oriented samples from 4 drill cores) from the Las Truchas iron-ore mining district, western Mexico. Numerous magnetic parameters have been determined to characterize the samples: saturation magnetization, Curie temperature, density, susceptibility, remanence intensity, Koenigsberger ratio, and hysteresis parameters. Magnetic properties are susceptible to variations in oxides content, deuteric oxidation, and hydrothermal alteration. Las Truchas deposit formed by contact metasomatism in a Mesozoic volcano-sedimentary sequence intruded by a batholith, and post-mineralization hydrothermal alteration seems to be the major event that affected the minerals and magnetic properties. Magnetite grain sizes in iron ores range from 5 to 200 μm , which suggest dominance of multidomain (MD) states. Curie temperatures are 580 - 585 °C, characteristic of magnetite. Hysteresis parameters indicate that most samples have MD magnetite, some samples pseudo-single domain (PSD), and just a few single domain (SD) particles. Alternating magnetic field demagnetization and isothermal remanent magnetization acquisition indicate that the natural remanent magnetization and laboratory remanences are carried by MD magnetite in iron ores and PSD–SD magnetite in host rocks. The Koenigsberger ratio falls in a narrow range between 0.1 and 10, indicating the significance of MD and PSD magnetite. So, we used magnetic petrology, comprehensive rock magnetism and conventional petrology to define the processes that create, alter and destroy magnetic minerals in rocks and ores. We try to relate all of these with observed magnetic anomalies (including modeling), to understand the geological factors that control magnetic signatures, which can be used to improve the geological interpretation of magnetic studies.

Keywords: rock magnetism, microscopy, magnetic anomaly model, Las Truchas iron ore, Mexico.