

Paleomagnetism of Late Paleozoic Strata and Mineralization in the Tri-State Lead-Zinc Ore District

D. T. A. SYMONS,[†] S. J. PANNALAL,

Earth Sciences, University of Windsor, Windsor, Ontario, Canada N9B 3P4

R. M. COVENEY, JR.,

Department of Geosciences, University of Missouri, 5110 Rockhill Road, Kansas City, Missouri 64110-2499

AND D. F. SANGSTER

2335 Russvern Drive, North Gower, Ontario, Canada K0A 2T0

Abstract

Paleomagnetic results are reported from five Upper Mississippian and 19 Upper Pennsylvanian limestone and black shale sites (272 samples) and from 42 boulders, oriented with respect to their bedding, of Mississippi Valley-type (MVT) mineralization from three mine waste piles (136 samples) in the Tri-State MVT district and along a northward transect to the Kansas City region. Thermal and alternating field-step demagnetization plus saturation isothermal remanence analysis show that the remanence of the samples is carried mostly by single to pseudosingle domain pyrrhotite and/or magnetite. Both outcrop and boulder samples carry a modern A component from a viscous remanent magnetization in the pyrrhotite and/or magnetite and from hematite produced by weathering. The site mean characteristic remanent magnetization (ChRM) from the five Mississippian outcrops (the D component), when combined with data from seven previously published sites, give a middle to Late Mississippian pole position (330 ± 6 Ma, 1σ), which indicates that the host rocks for the Tri-State MVT ores retain a primary chemical remanent magnetization. Similarly the site mean ChRM directions for the 19 Pennsylvanian outcrops (the C component) give a Middle Pennsylvanian pole position (313 ± 8 Ma, 1σ). Thus, despite the common presence of trace to minor MVT mineralization in a majority of these sites, they are also deemed to retain a primary chemical remanent magnetization. The MVT mineralization in the boulders yields a ChRM (the M component) with an average inclination of $7.4^\circ \pm 1.9^\circ$, which constrains ore genesis to an equatorial paleolatitude and which was true only from the Middle Pennsylvanian to the Middle Triassic for the study area. Two interpretations are given, using the paleomagnetic data that support epigenetic MVT ore genesis during either the Late Pennsylvanian (304 ± 6 Ma, 1σ) or the Late Permian (257 ± 10 Ma, 1σ).

[†] Corresponding author: e-mail, dsymons@uwindsor.ca