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Starting to track the Upper Mississippi Valley zinc–lead MVT fluid flow event, WI, USA

D.T.A. Symons*, S.J. Pannalal

Department of Earth and Environmental Sciences, University of Windsor, Windsor, ON, Canada N9B3P4

This study is the first of a series that aims to determine paleomagnetically the source of hydrothermal fluids that formed the archetypical Mississippi Valley-type (MVT) Zn–Pb deposits in Middle Ordovician carbonates of the Upper Mississippi Valley (UMV) ore district. These carbonates rest disconformably on ~50 m of Lower Ordovician carbonates, including the Oneota dolomite, and ~600 m of Cambrian–Lower Ordovician clastics that rest unconformably in turn on 1.3 Ga Precambrian basement. The lower Paleozoic strata have dips of <math><3^\circ</math> (average, ~1°) and are draped over the southern end of the Wisconsin Arch with E, SSE and SW dips into the Michigan, Illinois, and Forest City basins, respectively. The epigenetic sphalerite–galena mineralization occurs as open-space filling in faults, collapse breccias, vugs, etc., and gives Early Permian ages of 270 ± 4 Ma by the ^{87}Rb – ^{86}Sr method and 282 ± 10 Ma by paleomagnetism. Fluid inclusion homogenization temperature (Th) in ore of $\sim 115 \pm 30$ °C contrast with conodont colour alteration index (CAI = 1.0) temperatures in

host rock of ≤ 60 °C, showing that the ore was formed by ascending hydrothermal fluids that passed through the Oneota dolomites. Herein, we report paleomagnetic results from 9 sites (114 specimens) along an ~75 km ENE profile extending from the NE corner of the UMV district towards the Michigan Basin. Specimens from 8 sites carry a characteristic remanent magnetization (ChRM) that resides in pyrrhotite mostly and magnetite, and gives an Early Permian paleopole at 127.6°E , 47.9°N ($dp = 2.0^\circ$, $dm = 3.9^\circ$). Jackson and Van der Voo (1985) found that the ChRM of the Oneota dolomite to the NNW of the UMV district was carried by magnetite only and gave a primary Early Ordovician paleopole. Thus the Oneota paleomagnetic results to date favour fluid flow from the Michigan basin, are neutral for flow from the Illinois or Forest City basin, and militate against fluid flow either from an intrusive source below the UMV district or from Precambrian Shield to the north or northwest.

* Corresponding author. Tel.: +1 519 253 3000x2493; fax: +1 519 973 7081.
E-mail address: dsymons@uwindsor.ca (D.T.A. Symons).