Rock magnetism of the Zn-rich Pennsylvanian Stark black shale, Kansas City area, U.S.A.

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Rock magnetic results are reported from the metalliferous Stark black shale in the Upper Pennsylvanian Kansas City Group. One specimen per quarry (i.e. 10 specimens) was subjected to partial anhysteretic remanent magnetization (pARM) and saturation isothermal remanence (SIRM) acquisition tests. The results of the pARM test, SIRM test, S-ratio and biplots of susceptibility and remanence ratios indicate that the main remanence carrier is single domain (SD) to pseudosingle domain (PSD) magnetite or titanomagnetite with trace hematite. Hysteresis loops show a linear trend, which indicates either the presence of paramagnetic minerals such as pyrite and clays or simply the effect of the low magnetic intensities of the samples. Thermal step demagnetization is not a practical analytic method because of the high hydrocarbon content (greater than 17 wt. %) of the shale, and washing of powdered samples with dichloromethane is not effective in removing their organic content. Anisotropy of magnetic susceptibility (AMS) was measured on 108 specimens from 10 sites, and an oblate shape of the ellipsoid was observed at all sites. The specimens are dominated by a horizontal magnetic foliation, reflected in the tight vertical clustering of the minimum principal axis, due to vertical compaction of the black shales during burial. The AMS lineation shows three distributions: a) NNW to NE directions; b) scattered directions; and, c) WNW directions. These distributions, as well as the scattered characteristic remanent magnetization directions found for the 28 sampled sites, are interpreted to reflect the local paleocurrent direction during sedimentary deposition. The main remanence carriers are SD or PSD magnetite or titanomagnetite crystals that attached to clay particle surface during sediment transport. The clay-magnetite aggregates have a greater effective mass and much larger surface area than the magnetite grains alone, and therefore we postulate that they are easily biased by the gentle paleocurrent at each site. Thus the remanence directions are easily scattered by sedimentary processes. Conversely, we conclude that the black shale is mineralized during primary sedimentary processes and not by secondary hydrothermal processes.