

Paleomagnetism of the Red Dog Zn-Pb Massive Sulfide Deposit in Northern Alaska

MICHAEL T. LEWCHUK,^{†,°}

School of Geology and Geophysics, University of Oklahoma, Norman, Oklahoma 73019

DAVID L. LEACH, KAREN D. KELLEY,

U.S. Geological Survey, Box 25046, MS 973, Denver, Colorado 80225

AND DAVID T. A. SYMONS

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

Abstract

Paleomagnetic methods have isolated two ancient magnetizations in and around the Paleozoic shale-hosted Red Dog ore deposit in northern Alaska. A high-latitude, westerly magnetization carried by magnetite, termed characteristic remanent magnetization A, was found in rocks that have barite and/or substantial quartz replacement of barite. An intermediate- to low-latitude, southerly magnetization (characteristic remanent magnetization B) is carried by pyrrhotite and was found in rocks dominated by galena and sphalerite. The ages the two components are constrained by their relationship with geochemistry, radiometric age dating, and hypotheses for the Mesozoic tectonic history of the Brooks Range. Characteristic remanent magnetization A fails the fold test so it must postdate the end of Brookian orogenesis (~150 Ma). It is always found with replacement quartz that has a radiometric date (white mica from a vug, ³⁹Ar/⁴⁰Ar) of 126 Ma. The paleolatitude for characteristic remanent magnetization B is too shallow to be Mesozoic or younger, regardless of the model for the tectonic origin of northern Alaska, and must predate Brookian orogenesis. Geologic mapping suggests that most of the ore is syngenetic, formed at 330 to 340 Ma, and a radiometric date (Re-Os on pyrite) yields an age of 338 Ma. Since characteristic remanent magnetization B predates deformation, is found in mineralized rocks and is carried by pyrrhotite, it was probably acquired during the mineralizing process as well. The combined radiometric ages and paleomagnetic data sets can be best interpreted by assuming that northern Alaska was part of an accreted terrane that was translated northward by about 30° into its current location relative to the rest of North America and then rotated counterclockwise by 50° to 70°. This tectonic interpretation yields plausible magnetization ages for both characteristic remanent magnetization A and B. Geologic evidence, isotopic ages, and paleomagnetic data indicate formation of the deposit at a paleolatitude that is much lower than today.

[†] Corresponding author: e-mail, lewchukm@casady.org

[°] Present address: Casady School, 9500 North Pennsylvania Avenue, Oklahoma City, Oklahoma 73120.