Geophysical Research Abstracts
Vol. 19, EGU2017-1402, 2017
EGU General Assembly 2017

Environmental control on the paleo- and environmental magnetic record on the Yermak Plateau, Arctic Ocean

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The Yermak Plateau, situated north of Svalbard, has been recognized as one of several places in the Arctic Ocean where paleomagnetism yields controversial results. Despite low sedimentation rates, excursional paleomagnetic directions have been reconstructed from many cores in the region. Commonly reported geomagnetic excursions, i.e. Laschamp, Norwegian-Greenland-Sea and Blake, show considerably longer durations and younger ages compared to established short-lived geomagnetic polarity microchrons. An environmental control on the paleomagnetic record, connected to self-reversal during maghemitization of titanomagnetite has been proposed as one explanation for the wide occurrence of anomalous paleomagnetic data in the Arctic Ocean, but it remains unclear what mechanisms are responsible. Without independent stratigraphic control and independent dating it is difficult to distinguish between true and false records of the paleomagnetic field.

Here we present a paleo- and environmental magnetic record from an 8.6 m long oriented Kasten core (PS92/39-02) collected at 1464 m water depth on the Yermak Plateau (81.94°N 13.82°E). The density and magnetic susceptibility fit well into the regional stratigraphy and allow for correlation of different parameters with independently dated records. During AF demagnetization zones with a weak-medium gyro-remanence and/or spurious ARM acquisition were observed at fields above 70 mT, but in some instances above 50 mT, coinciding with shallow to positive inclination zones. Based on a gyro-cleaned record the initial paleomagnetic age model fits well into the regional constraints. The top of the core was assigned to be recent, the first observed excursion was assigned to Laschamp (ca. 41ka), the second to Norwegian-Greenland Sea (ca. 70-80 ka) and the top of the third to Blake (ca. 110 ka). With no excursions observed below Blake, the bottom of the sediment sequence was assumed to be younger than 180 ka (the age of the Iceland Basin/Pringle Falls excursion). We applied this basic age model to kARM/k (magnetic grain size proxy) and the resulting temporal trend is very similar to the global oxygen isotope record of ice volume. The waxing and waning of the Svalbard-Barent Sea Ice Sheet is the main control on terrigenous input to the Yermak Plateau and thus link d18O and magnetic grain-size. With records spanning more than 2-3 glacial cycles orbital tuning could further support our findings. Finally, we propose the use of magnetic grain-size (as of kARM/k) as an independent tuning mechanism for dating sediments from the Yermak Plateau.