PALEOMAGNETIC STUDY OF Satakunta Sandstone, SW-Finland: IMPLICATIONS FOR BALTICA DURING THE PROTEROZOIC

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A paleomagnetic study of the Proterozoic Satakunta sandstone, SW Finland, was done to obtain a new paleomagnetic pole for Baltica and to verify the union of Baltica and Laurentia between 1.83 to 1.26 Ga (Pesonen et al. 2003). The sandstone was deposited in a graben, formed by rifting 1.65 Ga ago, and later intruded by post-jotnian diabase (1.26 Ga). The age of the upper part of the sandstone is estimated to be ca. 1.3 - 1.4 Ga old (Kohonen & Rämö 2005).

A previous paleomagnetic study on Satakunta sandstone by Neuvonen (1973) yielded a mean direction of $D_m = 24; I_m = -41$ which is close to the post-jotnian diabase direction of $D_m = 35.5; I_m = -34$ and led us to question the primary origin of the sandstone direction.

Petrophysical, paleomagnetic and rock magnetic measurements were carried out on sandstone and diabase samples from Satakunta at the Solid Earth Geophysics Laboratory at the University of Helsinki. Stepwise AF and thermal demagnetization was performed on the samples and NRM measurements were carried out with a 2G SQUID magnetometer. Magnetic hysteresis and thermomagnetic measurements were done on selected samples using a VSM and KLY-3 kappabridge respectively.

The AF and thermal treatments coupled with hysteresis and thermomagnetic data suggest that the ChRM of the sandstone is carried by PSD and/or MD magnetite and hematite. In addition to PEF, two prevailing components were identified in the sandstone: a NE (SW) magnetic direction with a shallow inclination, and a NE direction with a moderately steep upward inclination (Figure 1 A). The latter is very similar to the ChRM of the diabase samples, and is therefore considered to be a secondary component created by baking from diabase intrusion at 1.26 Ga.

The occurrence of dual polarities and a positive tilt correction confirm the primary origin of the shallow component in the sandstone. A mean site direction (after tilt correction) was calculated at $D_m = 25.7, I_m = 2.8$ ($N = 37, \alpha_95 = 6.8, k = 38$), which yielded a paleomagnetic pole located at $27.1^\circ$N, $172.9^\circ$E ($A_95 = 4.8$). This implies that Satakunta sandstone was deposited earlier at ca. 1.6 Ga (Figure 1 B). Using the new paleomagnetic pole, a reconstruction of Baltica and Laurentia at 1.6 Ga will be presented at the symposium.
Figure 1. A) Mean directions of Satakunta sandstone and diabase: $SS_N =$ sandstone normal polarity, $SS_R =$ sandstone reversed polarity, $SS_{DB} =$ sandstone secondary (diabase) component, and $DB =$ diabase. B) Paleomagnetic poles of sandstone and diabase with 95% confidence circle plotted among paleomagnetic key poles (Buchan et al. 2000) and other relevant Proterozoic poles (Lubnina et al. 2010, Pisarevsky & Bylund 2010).

References


