



## **The use of Proterozoic dyke swarms as paleomagnetic indicators of broad-scale crustal rotation within the Archean Superior Province, Canada**

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Several Proterozoic dyke swarms, all with precise U-Pb baddeleyite and/or zircon ages, occur over an area of the southern Superior Province covering more than 300,000 square kilometres. Cutting across this region from James Bay to Lake Superior, is the Kapuskasing Zone (KZ), a 500 km-long fault zone along which dextral transpression at  $\sim 2.0$  Ga has produced crustal uplift locally in excess of 20 km and fault displacements of up to 70 km (Percival & West 1994). Regional changes in palaeomagnetic direction across the  $2446 \pm 1$  Ma western segment of the Matachewan swarm (Bates & Halls 1991; Halls & Stott 2003), show that it has been regionally distorted from an originally more linear pattern, a distortion that increases where the swarm crosses the KZ. A consequence of this deformation is that relative rotation has taken place between the two halves of the Superior Province across the KZ. This rotation is now supported by subsequent palaeomagnetic and U-Pb radiometric studies on  $2170 \pm 2$  Ma (Halls & Davis 2004) and  $2073 \pm 4$  Ma dykes (Buchan et al. 2004) that occur on either side of the KZ. Paleomagnetic comparisons of all three dyke sets across the KZ indicate that the western half of the Superior Province has rotated counterclockwise relative to the eastern half by about 20 degrees. New paleomagnetic and U-Pb ages suggest that 2121-2101 Ma Marathon dykes form a broad fan-shaped swarm that extends from Lake Nipigon in the west to the KZ in the east. The swarm shows an increase in mean declination eastwards, towards the KZ, a characteristic also shown by the Matachewan swarm. This result suggests that within about 100 km of the KZ the western half of the Superior Province has not deformed as a rigid plate, and therefore that the KZ is a much wider entity than previously recognized. In summary, results from more than 400 paleomagnetic sites from Ontario dykes show that the Superior province, despite being generally regarded as the epitome of a stable craton, has been

regionally deformed, probably at about 2 Ga.

*References:* Bates, M. & Halls, H. 1991, Can. J. Earth Sci. **28**: 1780; Buchan, K., Goutier, J., Hamilton, M., Ernst, R., Matthews, W. 2004. AGU-CGU Abstract, Montreal; Halls, H. & Stott, G. 2003, Ontario Geol. Surv. Open File Report. No. 6120, 7p; Halls, H. & Davis, D., Can. J. Earth Sci. **41**: 255