Heat flow around the Keweenawan rift system
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Abstract
The intrusion of large volume of mafic volcanic rocks during Keweenawan rifting has modified the average crustal composition and affects the present steady state heat flux in the region. We have combined new heat flow measurements in the Superior Province of the Canadian Shield and previously published data to characterize the heat flux field around the Keweenawan rift system. In the Nipigon embayment, North of Lake Superior, mafic intrusions associated with the Keweenawan rifting have resulted in a larger volume of mafic rocks in the crust and caused a very small < 3 mW/m² decrease in the mean heat flux. There is a very marked decrease in the heat flux ΔQ ~ 20 mW/m² beneath the western half of Lake Superior and to the west. The very low values of the heat flux correlate with the maximum Bouguer gravity anomaly. The surface heat flux is only a few mW/m² higher than the calculated mantle heat flux. This implies that the contribution of the entire crustal column to the heat flux is almost negligible and that the crust is entirely made up of depleted mafic volcanic rocks. In the eastern part and northeast of Lake Superior, there is a marked increase in heat flux that correlates with a lower Bouguer gravity anomaly. Local high heat flux anomalies due to intrusions by felsic rocks are superposed with a long wavelength trend of higher heat flux suggesting a more felsic crustal composition in the eastern part of the Keweenawan rift.

Conclusion
1) The Keweenawan rift is associated with a large volume of mafic intrusives that changed the bulk crustal heat production.
2) The surface heat flux decreases and the Bouguer gravity increases in the western part of Lake Superior due to the large volume of intrusives, although heat production of surface samples is low.
3) There is no heat flux anomaly associated with the Nipigon embayment suggesting that the total volume of mafic intrusives is spatially limited.

References

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