1. Introduction

The main objective of this study is applying numerical modelling to test the geodynamic hypothesis of Precambrian geotectonic terranes.

The Halls Creek Orogen (HCO) is a well-preserved and well-exposed Paleoproterozoic Orogenic belt (1910-1805 Ma) which can provide insight into the assembly of the Kimberley Craton to the edge of Diamantina Craton during the Nuna amalgamation. Therefore, we use the Halls Creek Orogen as a case study to reveal the tectonic evolution of a Precambrian Orogeny using numerical modelling.

The major features of the HCO are:
- Three tectonostratigraphic terranes (western, central, eastern zones)
- High gravity and metamorphic anomaly in the centre of orogen

There are controversies about how the Halls Creek Orogen developed. The Tickalara Metamorphics seems to be a key unit within the HCO for solving this controversy as either forming in:
(a) an ensialic marginal basin located in the margin of Kimberley Craton above the west-easterly-dipping subduction zone;
(b) an oceanic island arc setting above an easterly-dipping subduction zone outboard of Kimberley Craton (Sheppard et al., 1999).

3. Initial Setup of Numerical Models

The two plausible tectonic scenarios are examined through 3D thermo-mechanical-petrological numerical experiments based on 12VIS code (Gerya and Yuen, 2003) in:
(a) an ocean-continent subduction/collision setting or;
(b) an intra-ocean subduction setting.

4. Results of Numerical Experiment

The results of numerical models indicate that the most plausible processes that replicate the conceptual hypothesis of the Halls Creek Orogen and geological features is an ensialic marginal basin scenario (ocean-continent subduction/collision setting).

The numerical experiment of oceanic arc setting does not show the main features of conceptual model, including retreat of the subduction zone nor the reversal of subduction polarity.

References

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