Ultramafic rocks at the Isua supracrustal belt and East Pilbara Terrane are crustal cumulates, not slices of early mantle.

1. The timing of the onset of plate tectonics is uncertain. Dominant interpretations range from the late Paleoproterozoic (~3.8 Ga) to Neoproterozoic (~0.8 Ga).

2. Isua supracrustal belt dunites have been dominantly interpreted as depleted mantle slices. Mantle rocks that juxtaposed with crustal rocks via thrusting are only predicted by plate tectonic models.

3. We investigate photomicrographs, whole-rock major and trace geochemistry, and spinel geochemistry from ultramafic rocks of Isua supracrustal belt and East Pilbara Terrane to explore their origins.

If they are not consistent with mantle origins, or they can be viably interpreted as crustal ultramafic rocks (e.g., cumulates), then plate tectonics is not required to explain these rocks.

Findings:
1) geochemistry of Isua and Pilbara ultramafic samples are similar, and are more enriched in incompatible trace elements than most of the depleted mantle rocks;
2) spinels of Isua and Pilbara ultramafic rocks show moderate to high Cr# and low to moderate Mg#, which are inconsistent with the depleted mantle rocks;
3) Pilbara samples show cumulate textures;
4) Isua and Pilbara ultramafic samples show co-genetic relationships with local supracrustal rocks.

These findings indicate a cumulate origin, and are incompatible with a mantle origin. Therefore, plate tectonics is not required to explain these rocks.

Future targets: geochemical modeling to check whether refertilization to depleted mantle rocks could produce the whole-rock and spinel geochemical patterns observed in Pilbara and Isua samples.