Diapirism and sagduction in Archean greenstone belts: Insight from deposition and burial of "Timiskaming-type" sedimentary rocks in the Superior craton, Canada

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In Archean granite-greenstone terranes in the Superior craton, a dome and keel map pattern is evident on the regional scale, with greenstone belts occurring in narrow synclinal keels between open granitoid domes. These dome and keel structures have been interpreted as a result of diapirism and sagduction.

Neoarchean "Timiskaming-type" sedimentary sequences are the youngest supracrustal rocks in many Archean greenstone belts. They show features of structurally controlled basins and recent results show that they were deposited in synclinal keels between granitoid domes during diapirism and sagduction

The Kapuskasing uplift in the Superior craton provides an oblique section through the Archean mid to lower crust. The Borden Lake conglomerate (BLC) in the uplift is a Timiskaming-type sedimentary rock. U-Pb geochronological results show that it was buried to 20-30 km deep and metamorphosed to upper amphibolite and granulite grade (>700°C) less than ~7 m.y. after its deposition. This cannot be readily by conductive heat relaxation after crustal thickening caused by thrusting as (1) such a heating process is a slow one, and (2) there is no evidence for major crustal thickening in the region in the Archean. We suggest that diapirism and sagduction may provide an efficient mechanism for the sedimentation, burial and heating of the BLC. In this scenario, BLC was "sagducted" deep into the crust and surrounded by hot updoming TTG. This is a more efficient heating mechanism than thrust burial. In contrast to the thrusting model, the "sagduction" model does not lead to crustal thickening and may occur during crustal extension or thinning (see Lin et al., 2013, Precambrian Res., v. 238, p. 148-157). Assuming what is observed in the Kapuskasing uplift is representative of the middle to lower crust of the Superior craton, our interpretation implies that many lower grade greenstone belts and the associated Timiskaming-type sedimentary rocks in the craton, and potentially elsewhere, have deep and much higher grade "roots".