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How does the deep orogenic crust deform? The example of the Central Gneiss Belt (CGB), Grenville Province, Ontario.

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The CGB may be understood as the product of deep crustal nappe flow requiring high strains during thickening- (P1) and flow- (P2) related phases. We attempt to describe, in terms of structural geometry and rheology, how these deformations are accommodated.
The CGB consists of domains (thrust sheets) primarily composed of Proterozoic allochthonous and parautochthonous granitoid continental arc protoliths. These were either deformed at high grade (polycyclic) or never deformed (monocyclic) prior to granulite and amphibolite facies deformation in the Grenville orogeny.
Grenville-age structure: polycyclic rocks do not melt and in P1-2 form narrow gneissic shear zones transposing pre-Grenville fabric or uniform domain-wide transposition gneissosity. Monocyclic rocks interlayed with polycylic form thick uniform migmatite sheets. Monocyclic domains not associated with polycyclic units form nappe complexes of highly strained granulite gneiss (P1) or migmatite sheets (P2). At later stages of progressive deformation accompanying nappe flow (P2), gneissosity of monocyclic rocks may be deformed coplanar with P1 gneissosity or form spectacular shear zone systems (amphibolite facies-on-granulite facies, or amphibolite-on-amphibolite). Overall, tracts of uniform deformation (gneiss domains/thrust sheets) are dominant over discrete shear zones.
Grenville-age rheology: the largest scale rheological gradient, that between the Archean foreland, showing minor Grenville deformation, and highly deformed Proterozoic arc rocks, depends on the latters' protolith age and history as upper plate in a convergent margin. On the oceanward orogen margin, contrasting arc and back-arc properties resulted in P1 granulite- to amphibolite grade juxtaposition of upper- and deep crustal lithologies. At smaller scale, melting of fertile monocyclic granitoids is a major process, controlling formation of the large uniformly deformed thrust sheets (few internal strain gradients) and low competency layers within folded polycyclic domains. The contrasting styles of amphibolite facies-on-granulite facies and amphibolite-on-amphibolite gneissic shear zones are controlled by presence or absence, respectively, of fluid controlled rheological gradients. In summary, rheology of CGB-type deep crust will be understood when a deeper understanding is gained of the varying modes of softening of granitoids, the predominant rock type. What is clear from the CGB is the importance of two contrasting processes: formation of narrow shear zones of focussed deformation and melting of large volumes of rock producing diffuse deformation and few preserved strain gradients.