L3 Archean structural provinces < greenstone belts, granite-gneiss belt >

> Beaufort ... adjured his hydrographers never to slap a name on a feature out of vanity or favor, but to call the places they visited and observed by the names they already carried.
> —Scott Huler, *de-fin-ing the wind*, 2004.[1]

Two distinctive formations characterize the Archean structural provinces and map as: greenstone belts and granite-gneiss belts.[2] Intrusive bodies of anorogenic granite are sometimes present in both. The Superior province is typical (***Figure L3.1***).

Greenstone belts (***Figure L3.2***) are of volcanic and sedimentary rocks regionally metamorphosed at the greenschist facies. In them, the metamorphic mineral chlorite imparts its distinctive green color.

The greenstone formation includes great thicknesses of basaltic pillow lavas and lesser amounts of graded bedded graywackes, and, in places, enormous thicknesses of rhyolitic pyroclastics. Age relationships are hard to determine because dips tend to be near vertical, and numerous isoclinal folds are indicated by frequent reversals of way-up. Nevertheless, by appealing to overall superposition, the rhyolites are considered to be younger than the basalts when their outcrop is centrally within a synclinorium. Many of the synclinoria are only of basalt, or of graywacke, or of rhyolite.

Angular unconformities exist within the Archean, as careful mine mapping best shows. For example in the Red Lake area of Ontario, Archean pillowed basalts extensively overly Archean cataclastic rhyolites. However, the mine geologists of Red Lake Mine there find a regional angular unconformity between that shows the succession to be overturned.[3]

Greenstone belts contain numerous large granite-gneiss domes.

In map view, greenstone areas have cuspate outlines conformable to the margins of oval, granite-gneiss domes. This is universally the map pattern of Archean shields' geology.[4] The greenstone formations, presumed to be supercrustal, are allochthonous where no dike ("dyke" in Canadian spelling) or pod of granitoid of a bounding granite dome cuts them. The granite-gneiss domes have gneissic foliation conformable to their margins and have cores with inward-dipping weak foliation. The domes are judged to be diapiric.

The boundary between a sagduction structural trough, containing greenstone volcanics and sediments, and granite-gneiss dome is sharp in areas of low grade metamorphism but is blurred in areas of higher metamorphic grade where the primary stratification of greenstone volcanics and sediments has been transposed into metamorphic foliation conformable to, and can be schleiren within, the mantle gneiss of the granite-gneiss dome.

Banded ironformations with a great range of Archean ages occur only in greenstone belts and by this are relatable to submarine volcanism. Referred to as Algoma-type BIF, volumetrically they account for only 6 percent of BIF deposits.[5]

Granite-gneiss belts are mapped as just that. In them, the "granites" are migmatized metasediments, acidic volcanics and intrusives, and the "gneisses" are migmatized basic and ultrabasic volcanics and intrusives. Regional metamorphic grade is at the eclogite and granulite facies and, in some belts, reaches as high as the charnokite facies.[6] The dry regional metamorphism was so because the steeper temperature gradient of the young and hotter Earth drove off volatiles from rocks below a relatively shallow depth. Archean radiometric ages retained by micas in these rocks, indicate no deep burial in the billions of years since they surfaced, or became near surface. ❑

Figure L3.1[7]

Named subprovinces of the Superior structural province of the Canadian Shield.

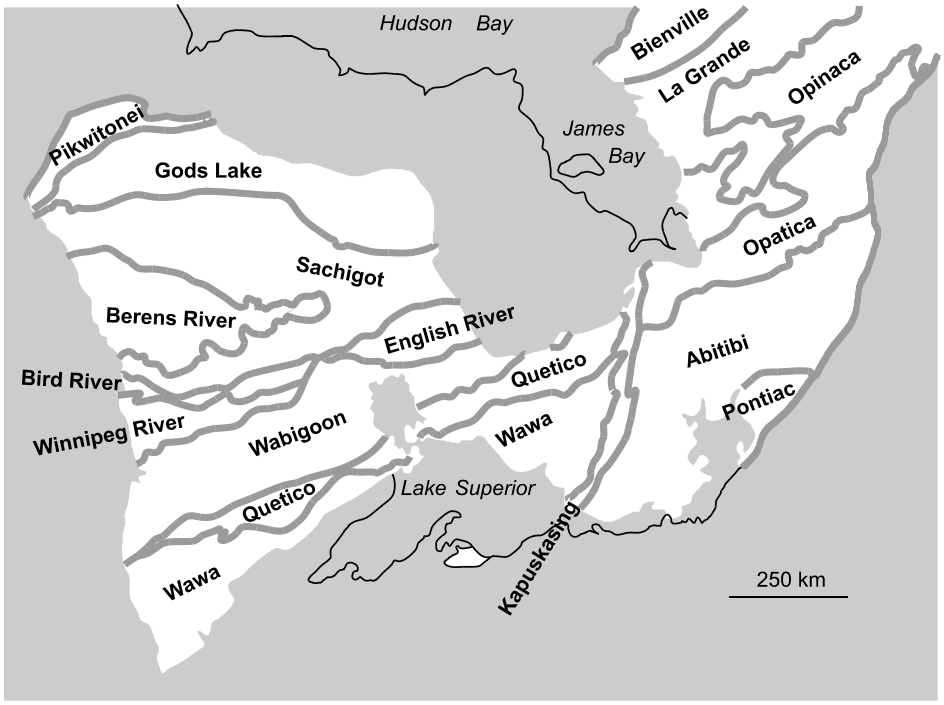

Figure L3.2[8]

Map showing the Archean igneous and sedimentary belts within the Abitibi structural subprovince of the Canadian Shield.