

Abstract

ABSTRACT :

The Lac Soisson intrusive suite consists of a swarm of small plutons and plugs of olivine-gabbro, gabbroic and troctolite composition that were emplaced into Archean to Paleoproterozoic crust of the western Core Zone, west of the de Pas Batholith. These intrusions are essentially non-metamorphosed, with unaltered olivine visible in hand specimen and thin section. They were mapped in detail by the Ministère de l'Énergie et des Ressources naturelles (MERN) in 2013 as part of the Lac Saffray mapping project in the Core Zone, and revisited this past summer where a B.Sc. Honours thesis was initiated (Fleury, 2016), supported by the MERN. In 2000-2002, these intrusions were targeted by the Western Mining Corporation (WMC) as part of their "Quebec-7" Ni-Cu-PGE exploration program along the western margin of the St. Churchill Province. Some of the values reported by WMC range up to 2% chalcopyrite, <2% pentlandite and 108 ppb PGEs over meter-length sections in drillcore. During our targeted mapping in 2014 we sampled one of the main gabbroic phases of the intrusion for U-Pb dating. The sample yielded abundant, large baddeleyite and zircon crystals, which were analyzed at the Geological Survey of Canada laboratory in Ottawa. Preliminary TIMS results stemming from the baddeleyite ages suggest that the magma was emplaced at 1312 ± 1 Ma, slightly younger than the ca. 1333 ± 1 Ma Ni-bearing intrusions of the Voisey's Bay complex in Nain. Zircon from the same Lac Soisson sample, however, yields a younger SHRIMP concordia age of 1295 ± 11 Ma. Interestingly, some of the Voisey's Bay zircons yield ages that are comparable with baddeleyite ages (1333 Ma), whereas others yield ages that are significantly younger, at ca. 1305 Ma. During the summer 2014, east-west oriented olivine gabbro dykes were also mapped and sampled as part of the regional mapping program. These E-W dykes are parallel to a set of crustal-scale faults and lineaments that appear to be associated to crustal extension related to emplacement of the Nain Plutonic Suite. Some may in turn be feeders to the Lac Soisson intrusions. However, preliminary TIMS results suggest an age of ca. 1270 Ma for one of these dykes. The age correlation shown herein suggests that Ni-Cu mineralized, olivine-bearing mafic intrusions of the Soisson Suite may very likely be related to the Voisey's Bay intrusions but were emplaced more than 300 km to the W-NW of the latter, in the western margin of the Core Zone.

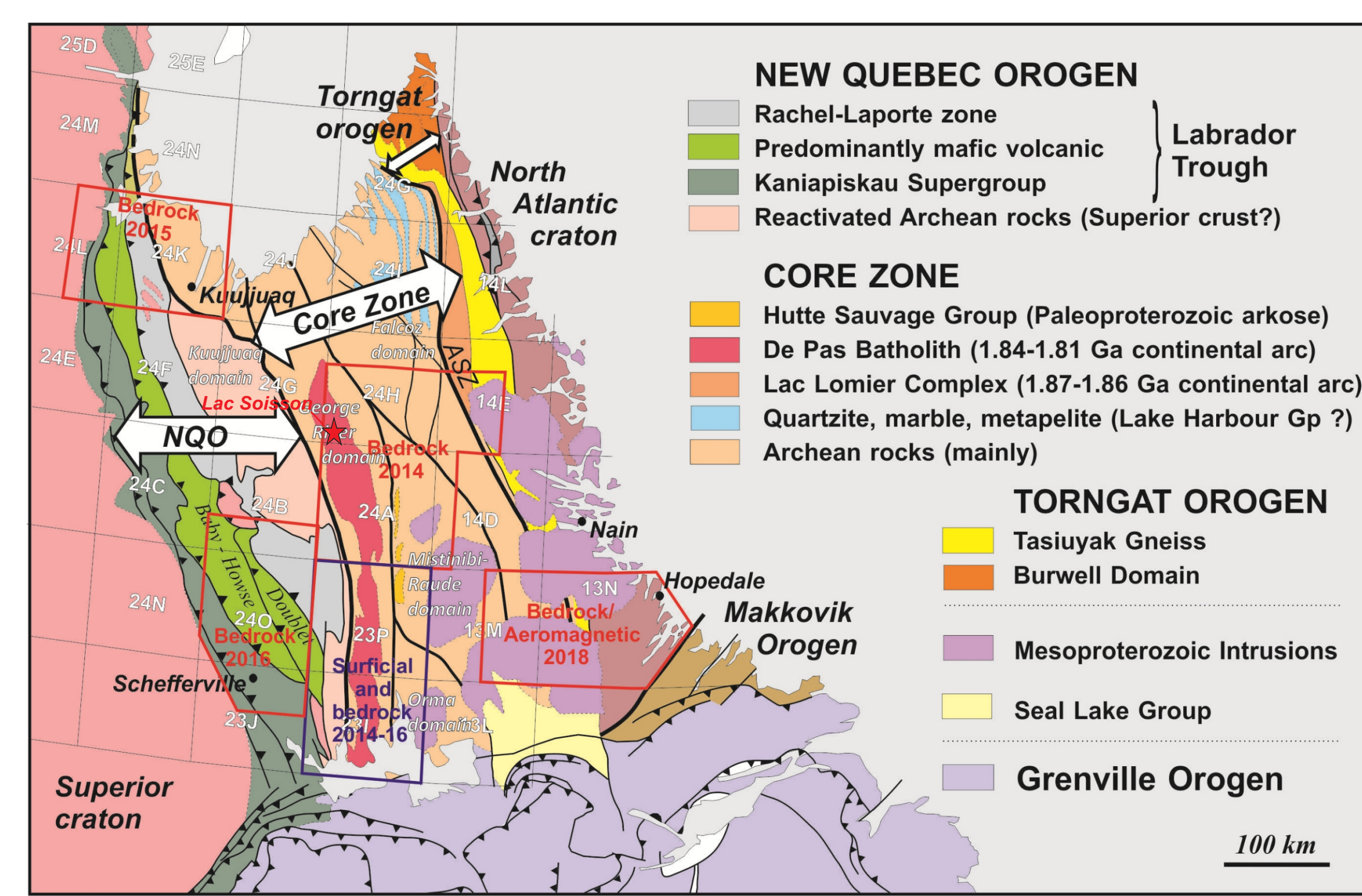


Figure 1: Simplified geological map of the Precambrian Shield east of the Superior Craton in Quebec and Labrador. The boxes with red margins indicate areas investigated for bedrock mapping (see Corrigan et al., 2018). The box with a blue outline indicates the area investigated for both surficial and bedrock geology (ibid). The location of the Lac Soisson intrusion is shown (star). Modified after James et al. (2003).

Map sheet NTS 24G showing location of Soisson-type intrusions

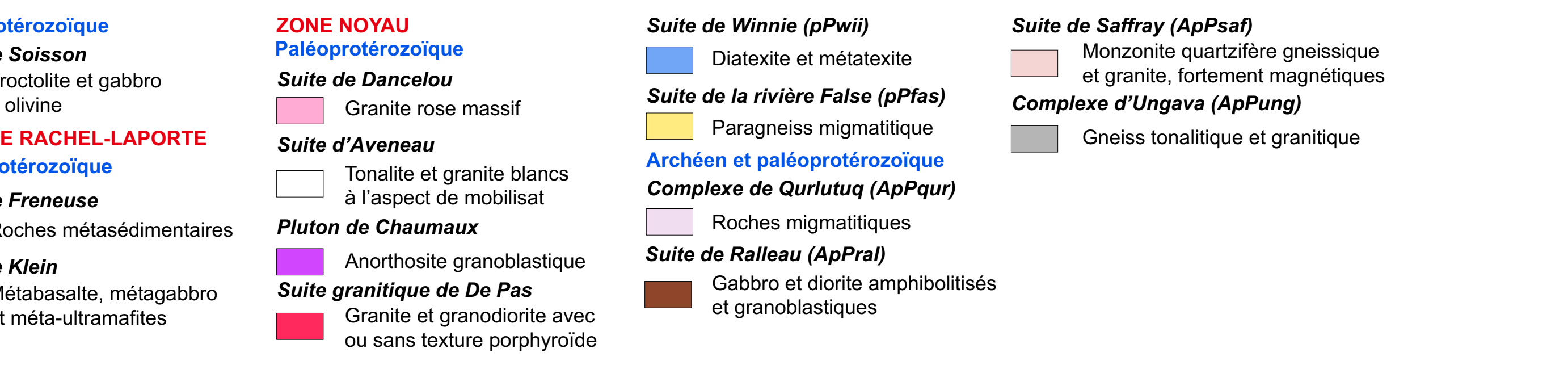
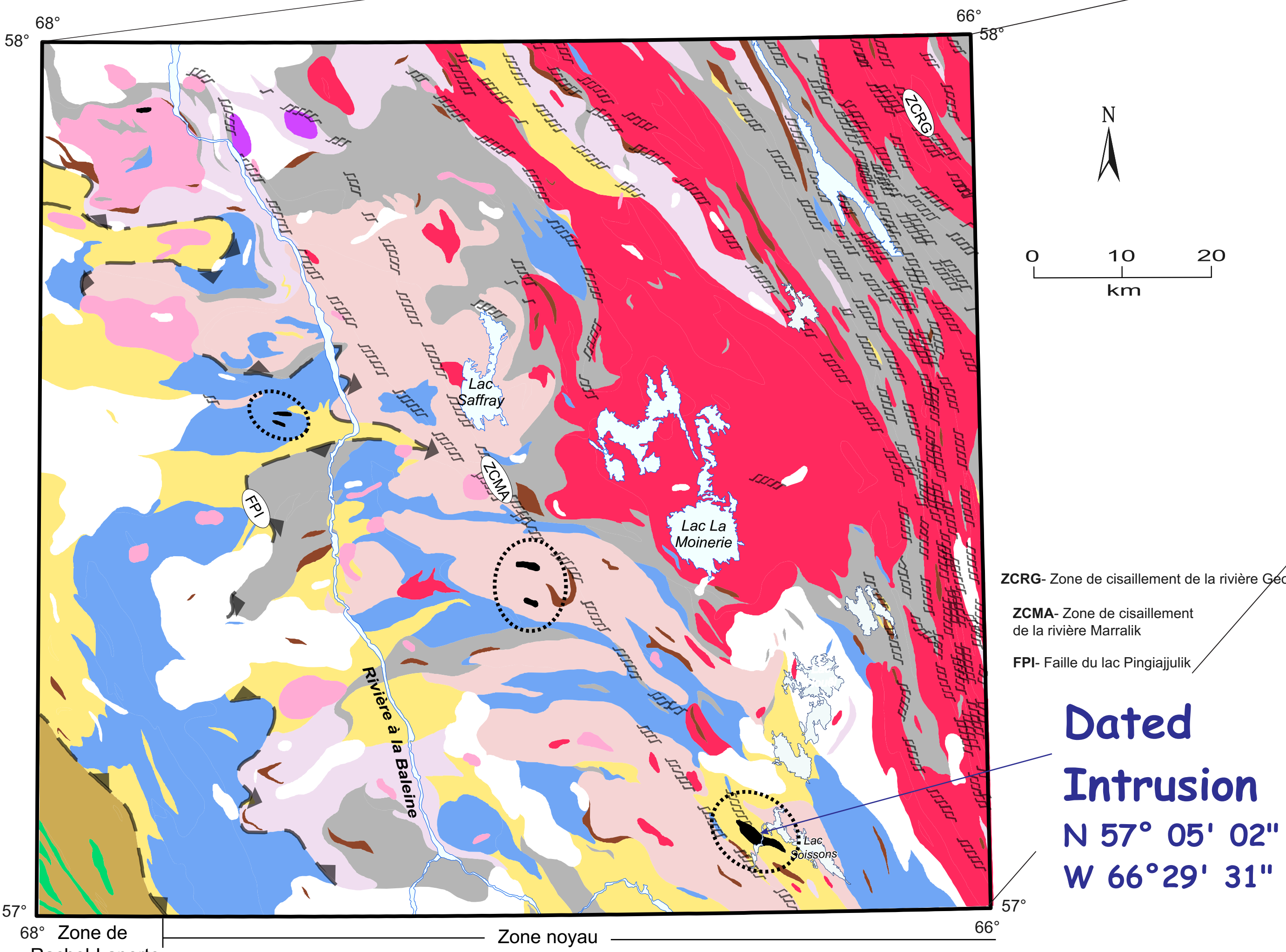


Figure 2: Simplified geological map of the Lac Soisson area, after Lafrance et al. (2014).

Aeromagnetic survey and regional geology

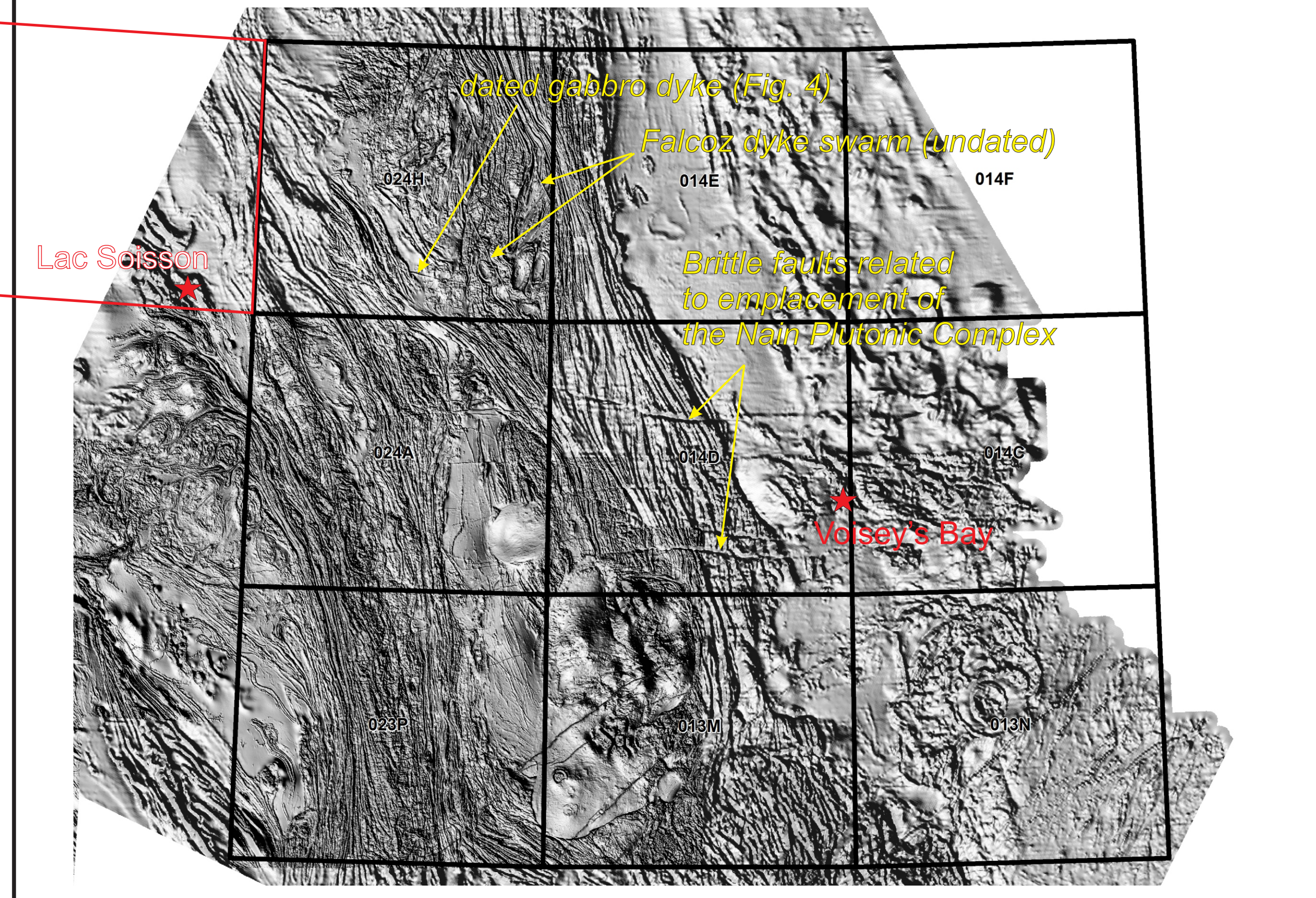
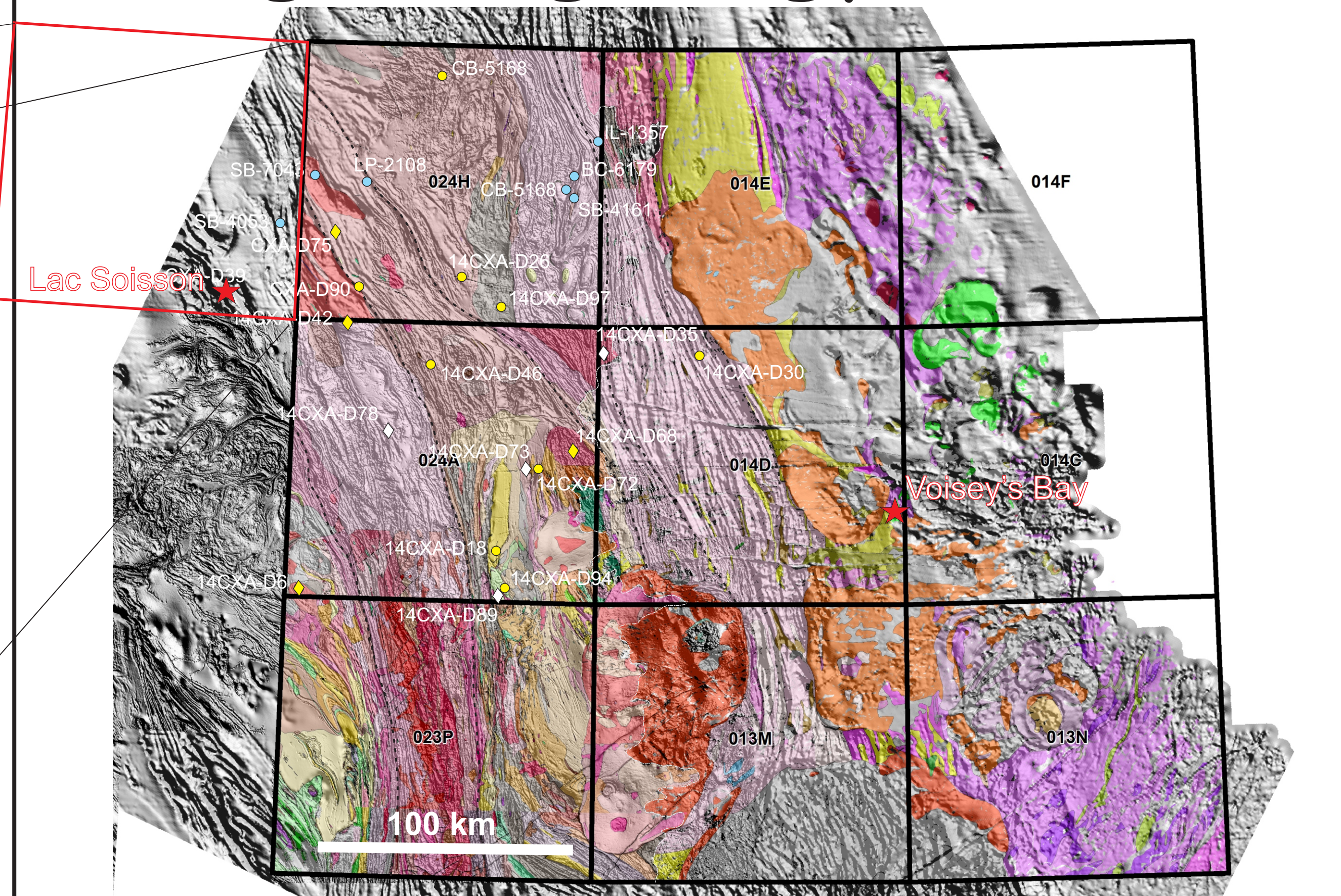


Figure 5: Greyscale aeromagnetic maps of the Core Zone area in northern Quebec and Labrador, showing the sample locations and the location of Voisey's Bay. The map above shows regional map units (with transparency) from SIGEM as well as the Newfoundland and Labrador Department of Natural Resources. Red stars indicate the locations of Lac Soisson and Voisey's Bay.

U-Pb geochronology

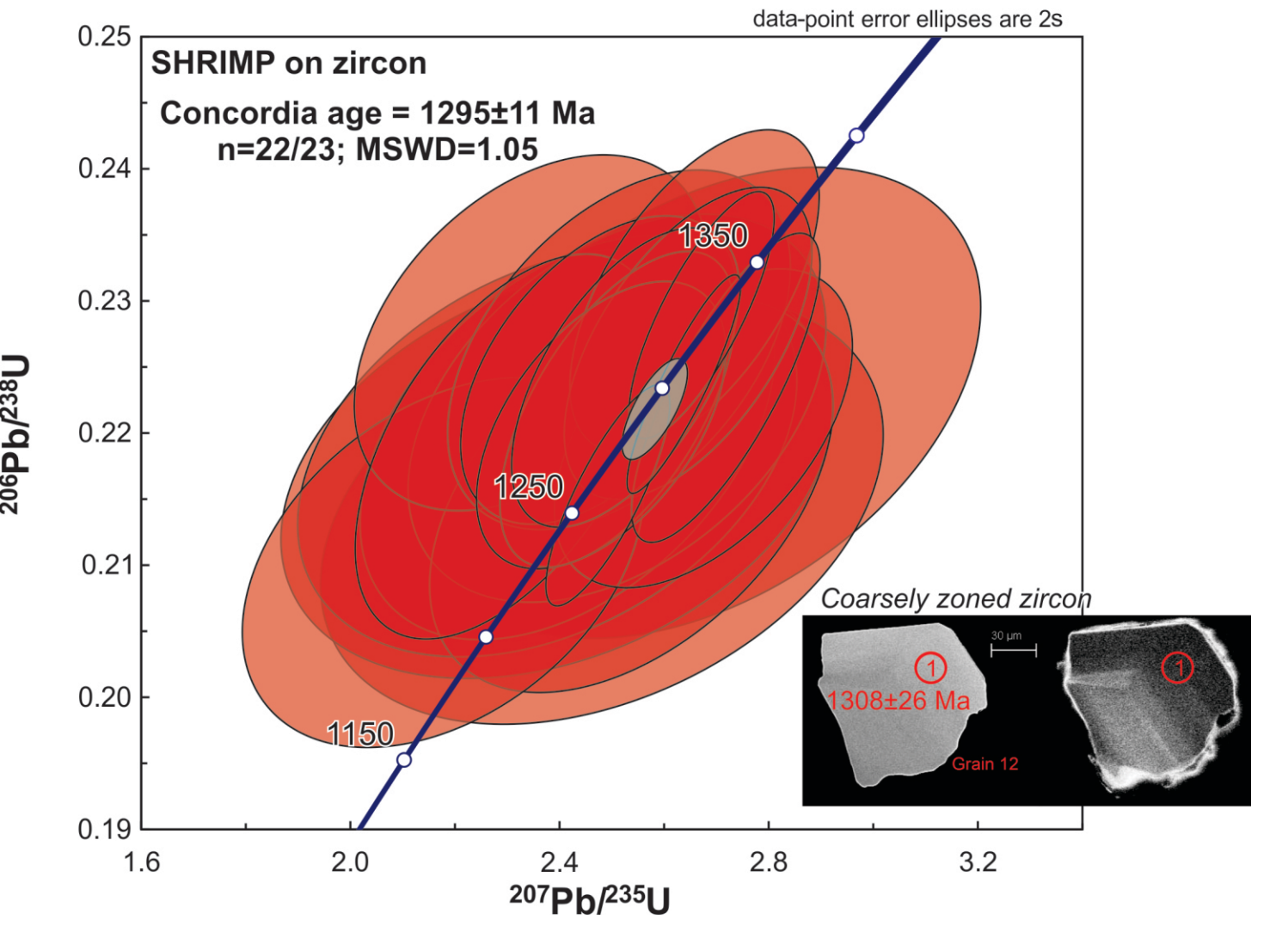
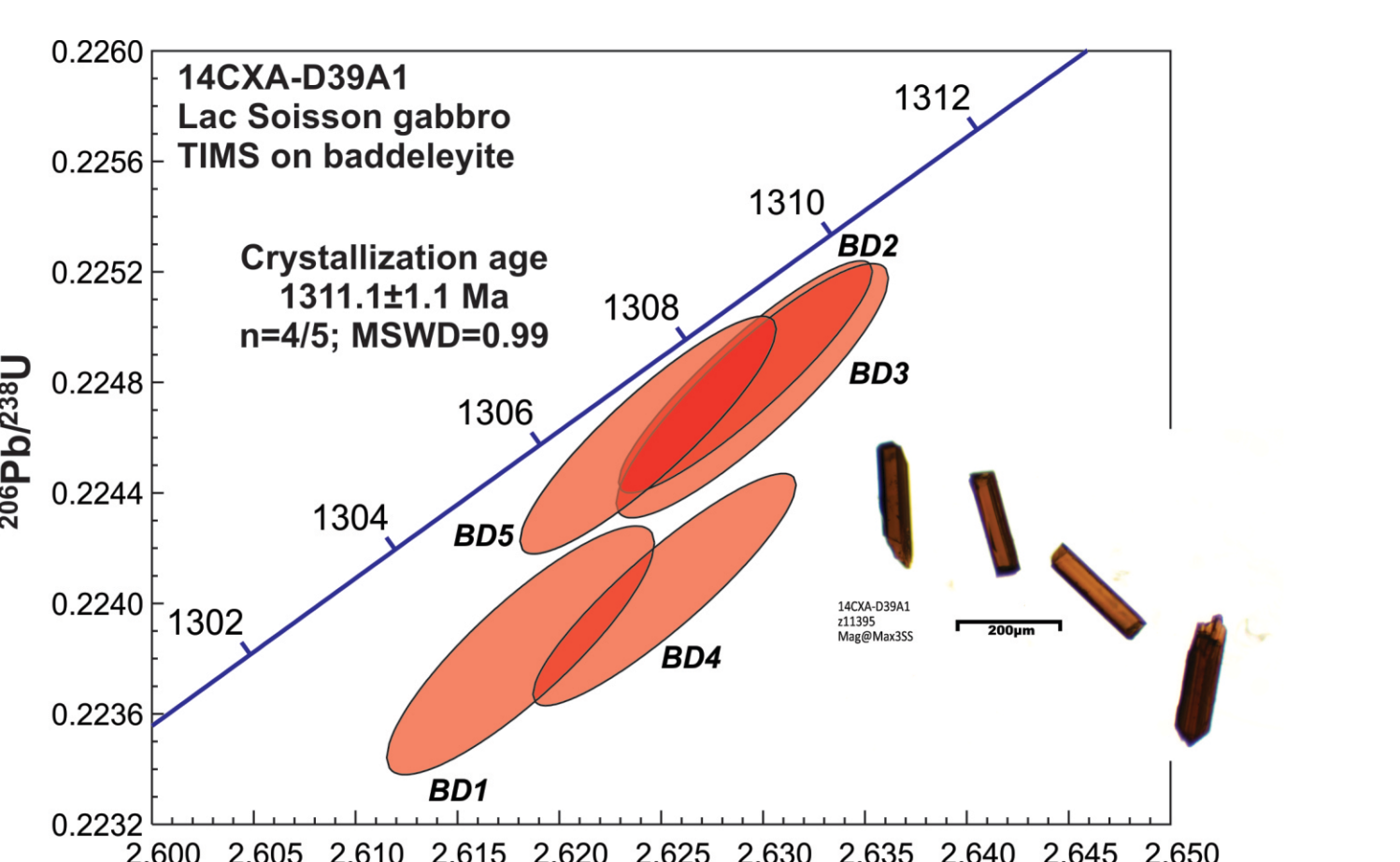
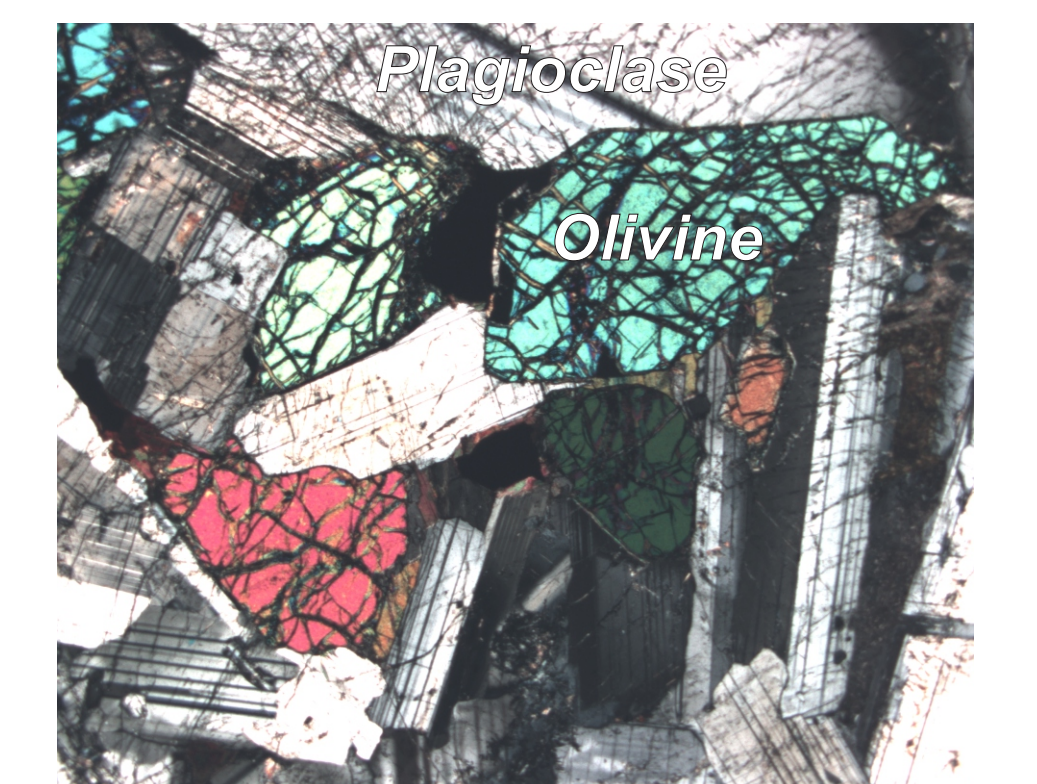


Figure 3: Coarse baddeleyite from the Lac Soisson gabbro yields a weighted mean ²⁰⁶Pb/²³⁸U age of 1311.1 ± 1.1 Ma (TIMS data; n=4/5; MSWD=0.99), interpreted as the crystallization age of the gabbro. Coarsely zoned zircon from the same rock yields a younger Concordia age of 1295 ± 11 Ma (SHRIMP data; n=22/23; MSWD=1.05), which may reflect new growth as a result of metamorphism or fluid infiltration (cf. Amelin et al., 1999). Photomicrograph above is from the dated Soisson troctolite and shows unaltered olivine in equilibrium with plagioclase. Base width is about 5 mm.

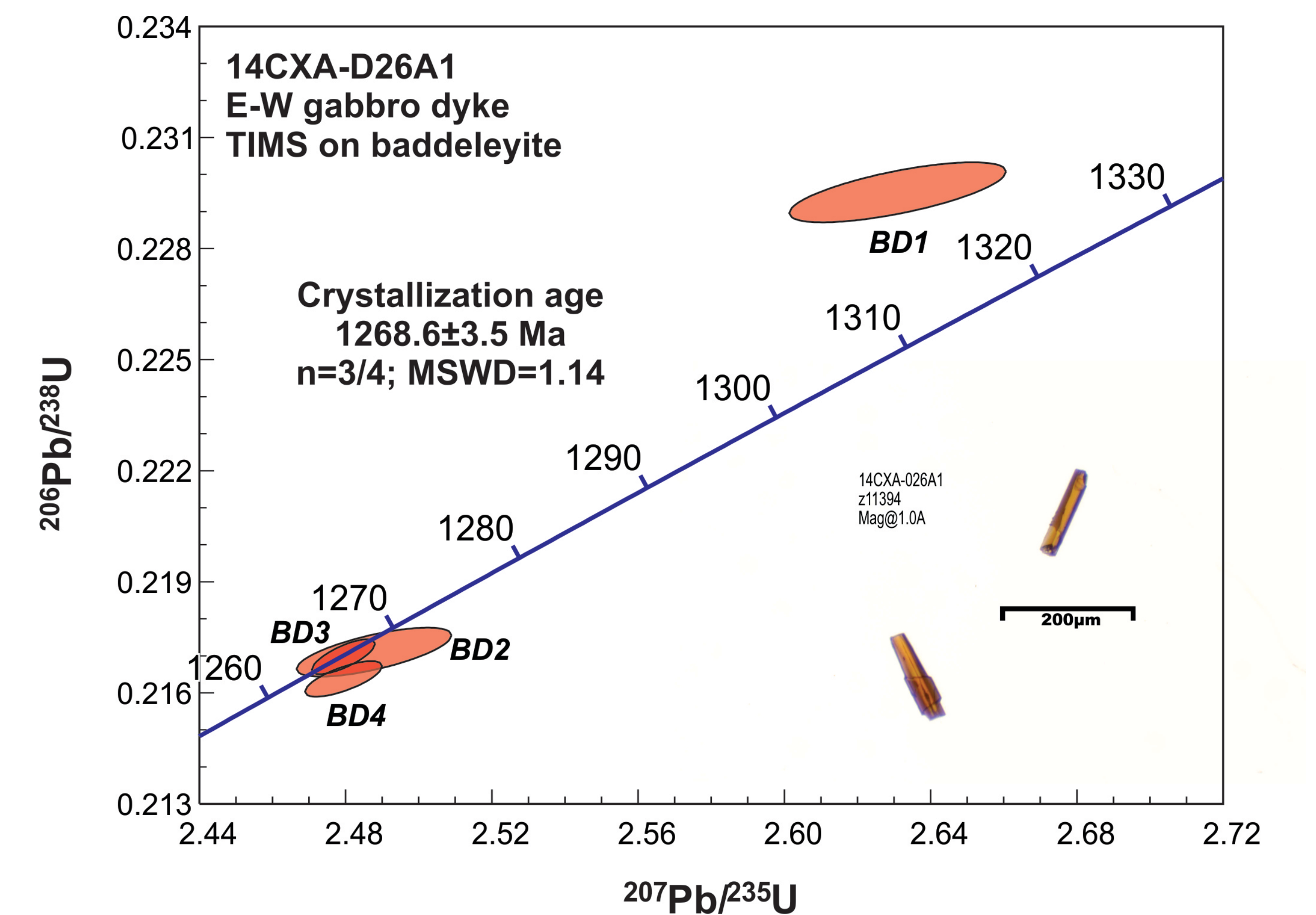


Figure 4: Three single grain, concordant analyses of baddeleyite (TIMS results) yield a crystallization age of 1268.6 ± 3.5 Ma (n=3/4; MSWD=1.14) for an E-W gabbro dyke emplaced along a brittle fault. This olivine gabbro does not contain any zircon. Photograph above from the dated outcrop shows typical weathering of orthopyroxene-bearing outcrops of Meso-proterozoic age in the area, in this case forming corestone.

Discussion

The presence of Mesoproterozoic-age mafic plutons, including mineralized troctolite, that overlap in age with the Nain Plutonic Suite but occur more than 300 km west of Voisey's Bay is intriguing and raises important questions about a possible connection from a genetic point of view - as well as an exploration point of view. It also raises questions about the nature of the crustal (lithospheric?)-scale set of east-west faults that transect the area, and their potential role as conduits for emplacement of mantle-derived magma of the Nain Plutonic Suite. We intended to test that by dating the east-west gabbro shown in Figure 5, but it yielded an age (Fig. 4) that is slightly younger than the dated Soisson intrusion. This does not preclude a similar source and affinity, but a direct link with the latter is unlikely. The slightly younger zircon ages versus the baddeleyite ages observed in the Soisson Troctolite (Fig. 4), follows a similar pattern to the relationship between these two phases reported from the Eastern Deeps intrusion by Amelin et al., (1999), suggesting similar conditions of crystallization. Further geochemical and isotopic analyses could potentially help consolidate the comparisons between the Soisson plutonic suite and Voisey's Bay, potentially opening-up new models for exploration of Ni-Cu bearing magmatic sulphides in the region.

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