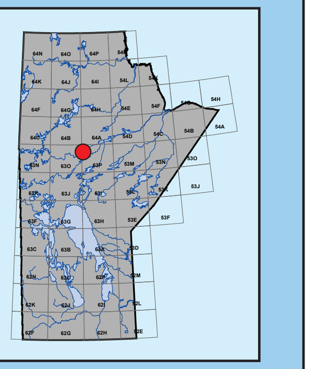
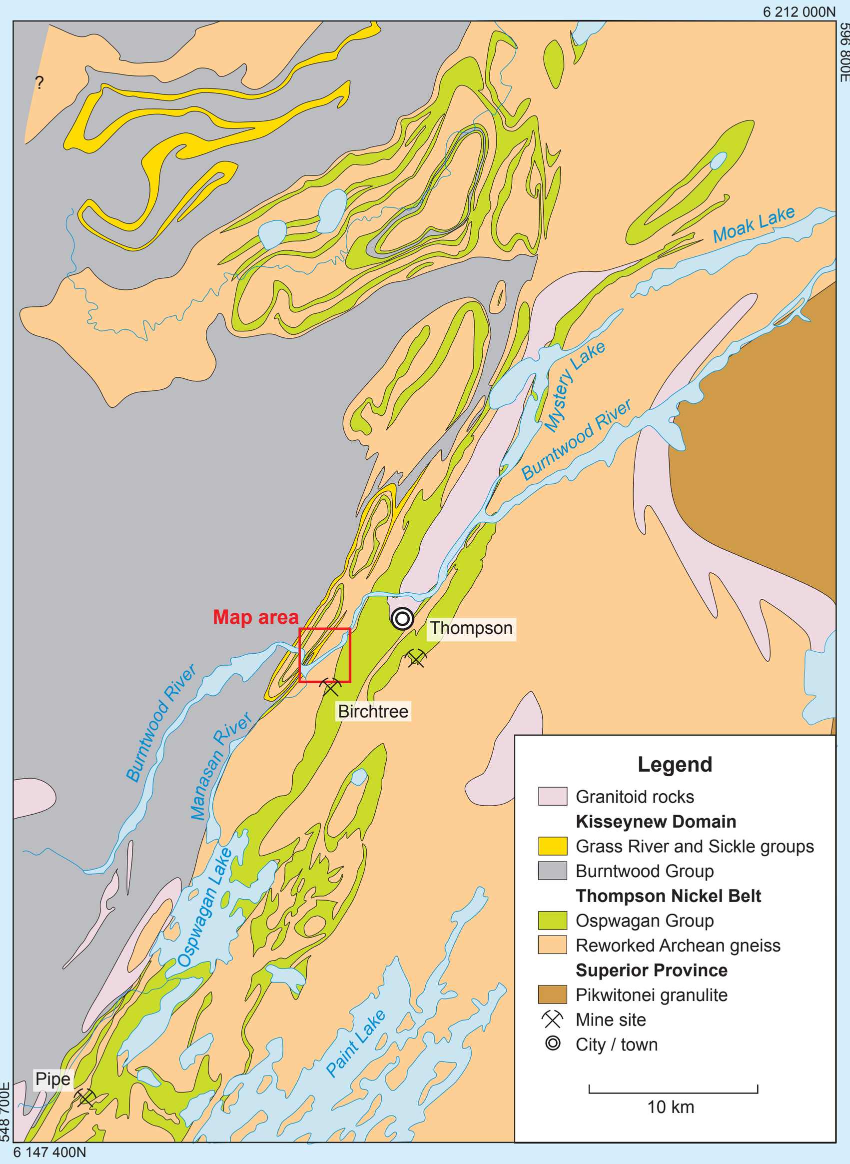
Geological investigations in the Manasan Falls area, Thompson Nickel Belt, Manitoba

C.G. Couëslan



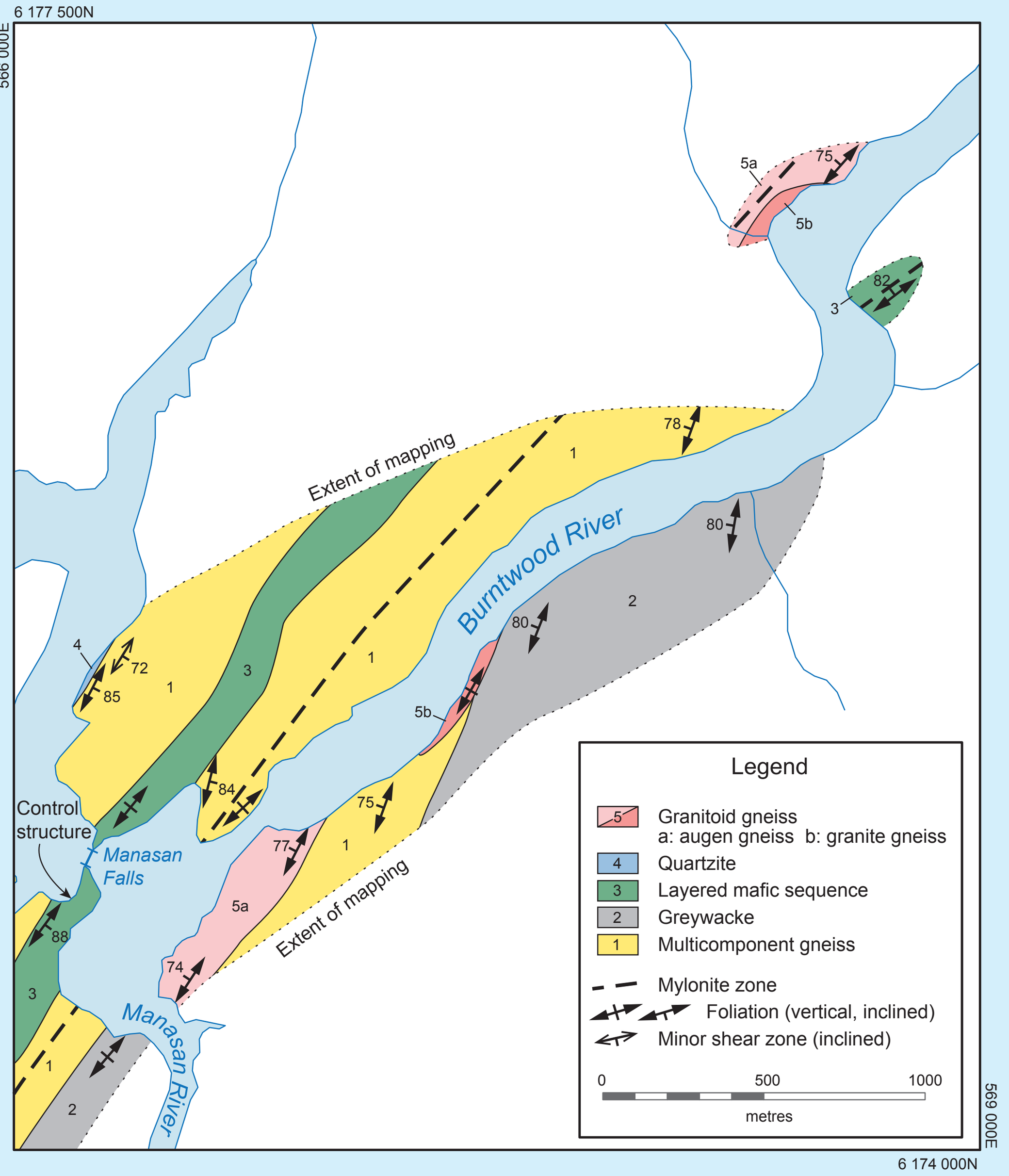


Summary

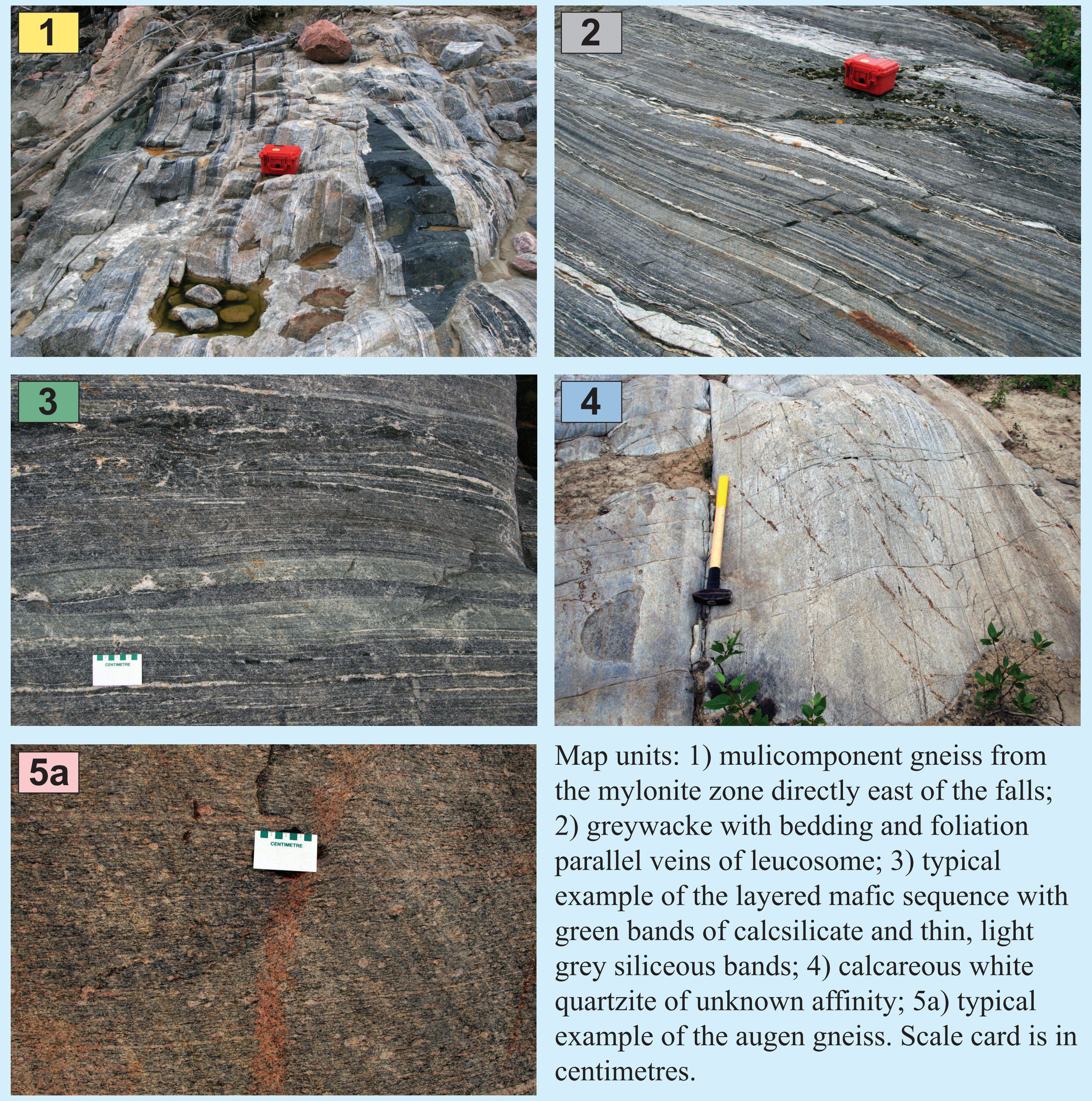
In July 2011, the water levels on the Burntwood River in Thompson were 4–5 feet below average levels. The low water levels allowed for the examination of extensive outcrops in the Manasan Falls area that are typically submerged or otherwise inaccessible. Previous work from diamond drillcore had recognized metamorphosed supracrustal rocks, tentatively identified as Grass River Group, in the Manasan Falls area. Mapping of the area revealed the presence of a supracrustal sequence that is likely Archean. A layered mafic sequence consists of banded para-amphibolite or mafic metavolcaniclastic rock, siliceous metasedimentary rock, metagreywacke, and metapelite and metasemipelite. Other units in the area consist of Archean multicomponent gneiss, white quartzite of unknown affinity, and an augen gneiss – granite gneiss suite that is interpreted as Paleoproterozoic.

Several lines of evidence suggest that the layered mafic sequence is unrelated to similar rocks in the Grass River Group. At the southeast end of the sequence amphibolite layers are interbedded with clastic sedimentary rocks and rare marble. At the northwest end of the sequence the banded amphibolite grades into siliceous sediment over a 15 m interval. Although volcaniclastic rocks are present in the lower members of the Grass River Group, the absence of conglomeratic and arkosic rocks suggest the layered mafic sequence is not correlative with this group. In addition, marble layers have not been reported from the Grass River Group and are not likely to occur in the fluvial-alluvial environment inferred for the Grass River Group.

The associated greywacke is petrographically similar to that described at Paint Lake, which is interpreted to be part of an Archean supracrustal sequence. Layered mafic rocks are also present at Paint Lake and were previously interpreted as layered mafic intrusions consisting of metagabbro and an anorthositic metagabbro phase. The layered mafic rocks at Paint Lake are typically quartz-bearing. Portions described as anorthositic metagabbro regularly contain up to 20% quartz and the most leucocratic layers locally contain up to 60 % quartz, suggestive of a sedimentary protolith. However, the metagabbro at Paint Lake is characterized by abundant garnet porphyroblasts, which are rare at Manasan Falls. This may be related to the higher metamorphic grade at Paint Lake rather than bulk composition. More work is required for any direct correlation to be made between the Paint Lake layered metagabbro and the layered mafic sequence at Manasan Falls[1].

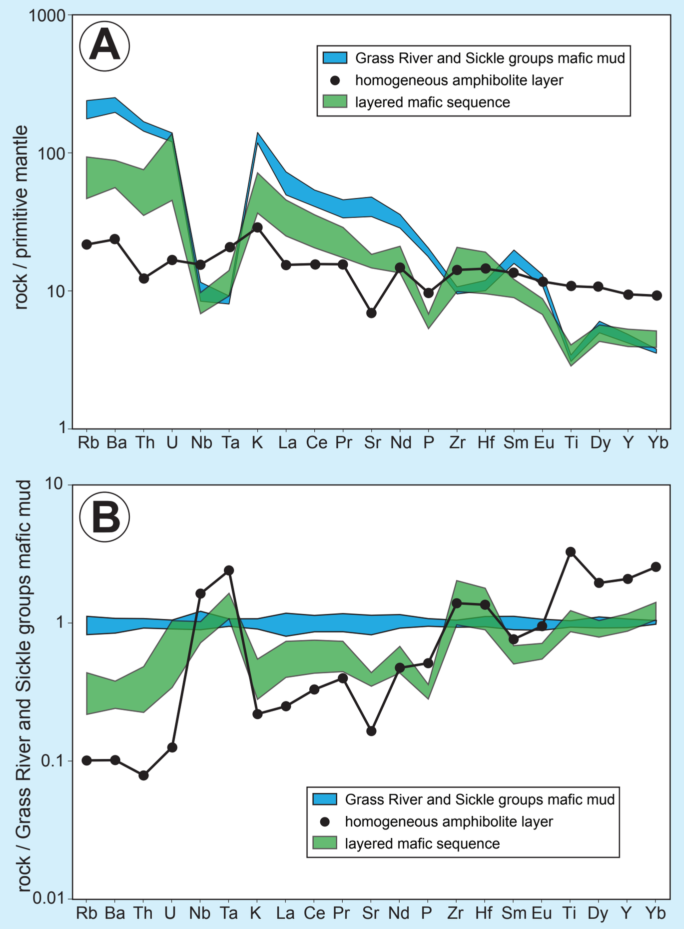


Map units



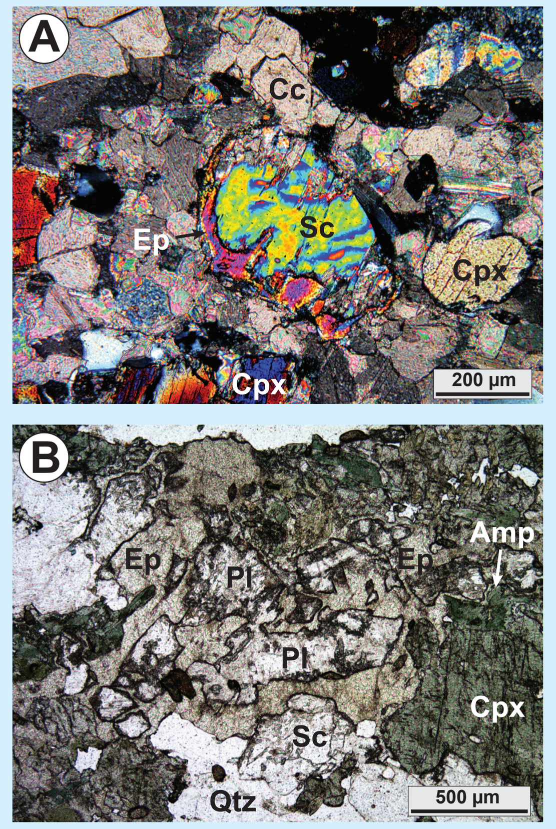
Map units: 1) mulicomponent gneiss from the mylonite zone directly east of the falls; 2) greywacke with bedding and foliation parallel veins of leucosome; 3) typical example of the layered mafic sequence with green bands of calcsilicate and thin, light grey siliceous bands; 4) calcareous white quartzite of unknown affinity; 5a) typical example of the augen gneiss. Scale card is in centimetres.

Lithogeochemistry

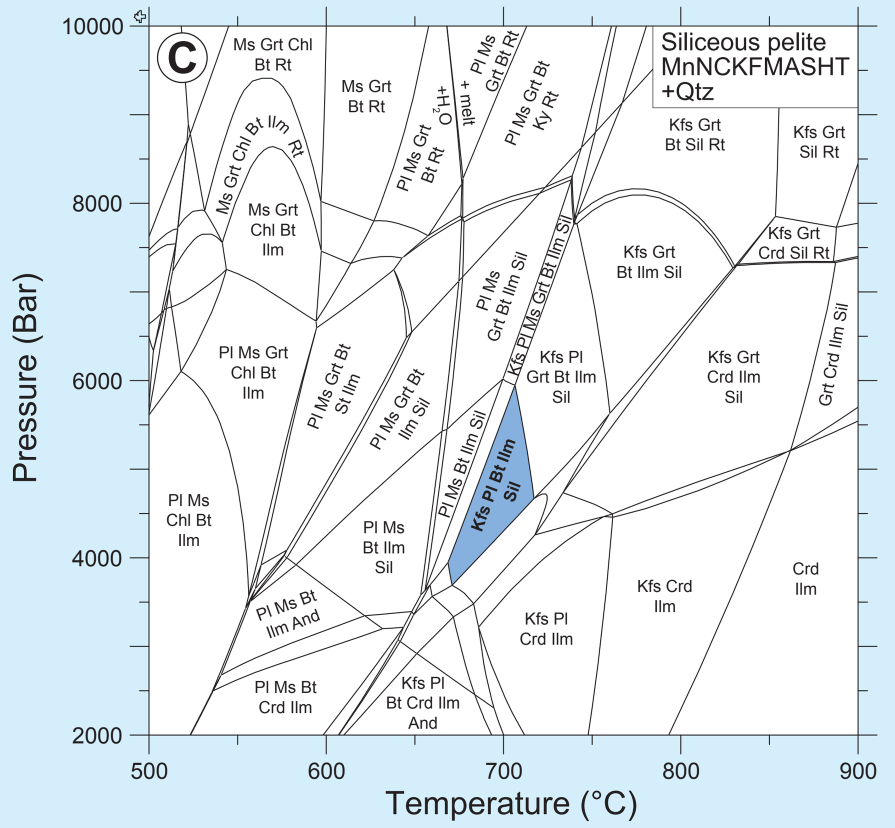


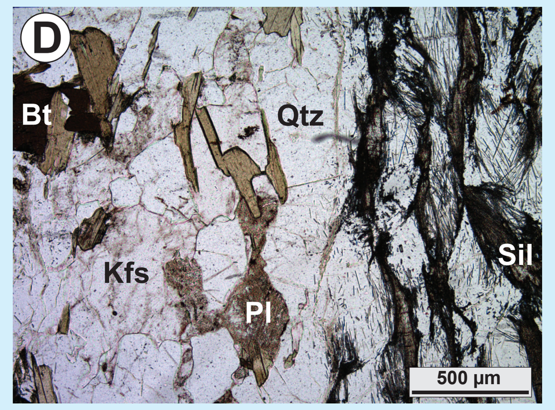
Trace-element diagrams normalized to A) primitive mantle[2] and B) average mafic mud from the Grass River and Sickle groups. The relatively flat-lying pattern of the homogenous amphibolite layer in A) suggests it represents a mafic dyke. The rocks of the layered mafic sequence are typically depleted in LILE and LREE, and enriched in HFSE relative to the Grass River and Sickle groups.

Metamorphism

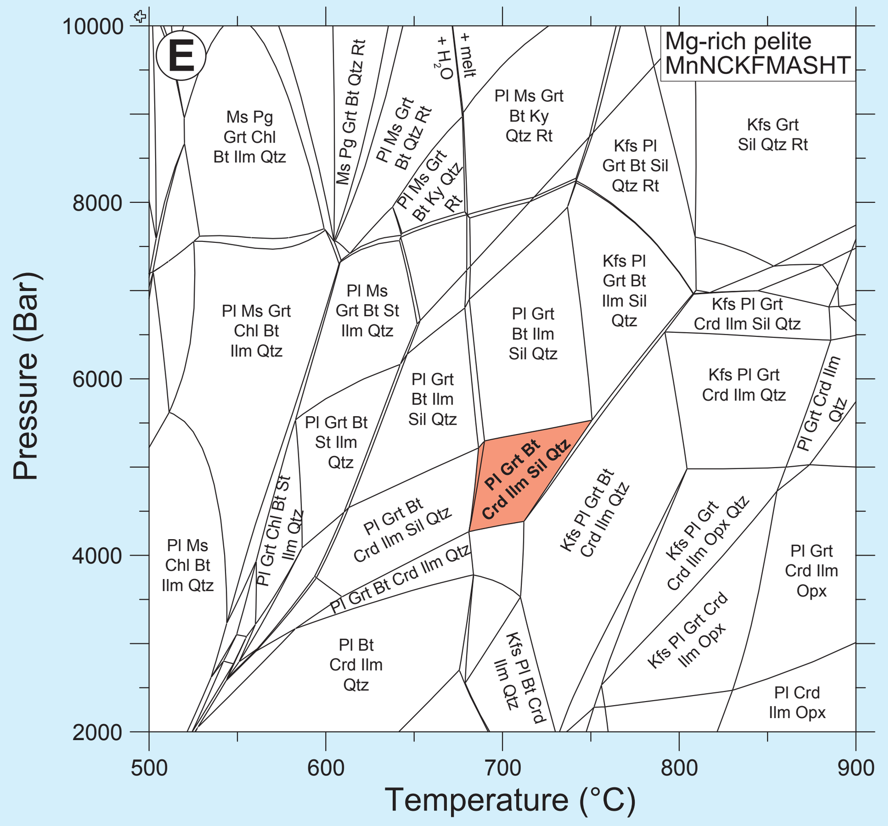


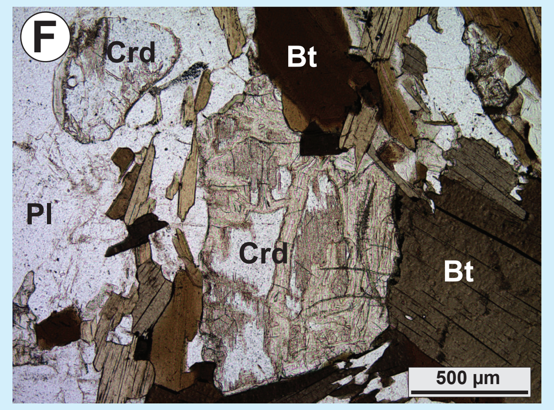
A) Photomicrograph from the thin marble horizon. Peak metamorphic scapolite is partially replaced by retrograde calcite and epidote. B) Photomicrograph from a calcsilicate horizon in the banded amphibolite. Peak metamorphic plagioclase and clinopyroxene are partially replaced by retrograde epidote and amphibole, respectively.



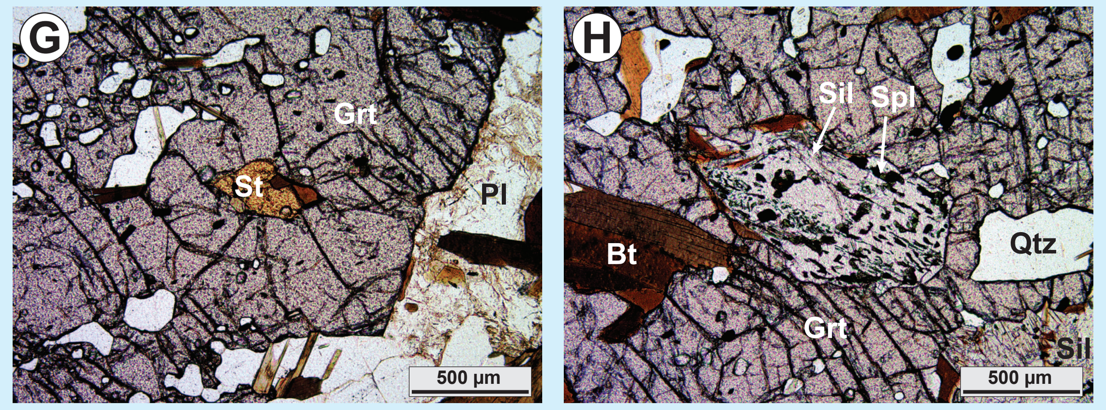


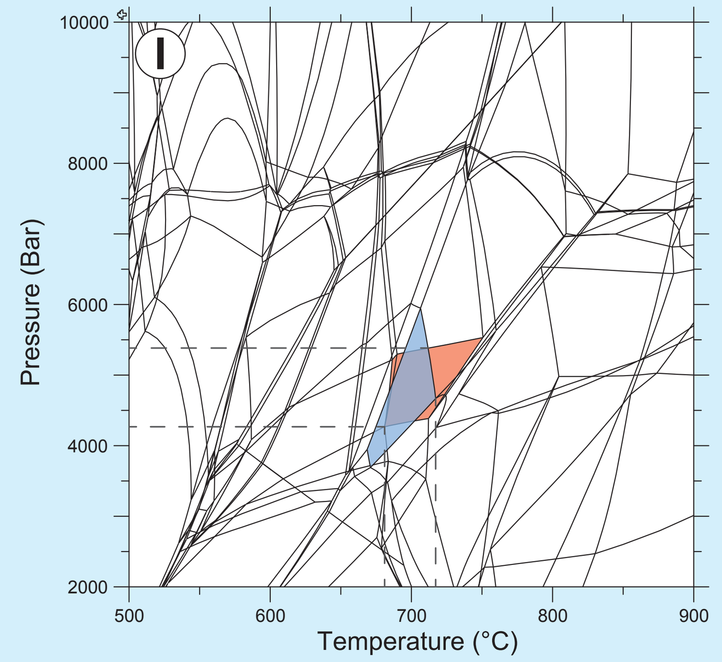
C) Equilibrium assemblage diagram[3] for siliceous pelite. The peak metamorphic assemblage, Kfs + Pl + Bt + Ilm + Sil + Qtz, is indicated by the blue field and shown in photomicrograph D).





E) Equilibrium assemblage diagram[3] for Mg-rich pelite. The peak metamorphic mineral assemblage, Pl + Grt + Bt + Crd + Ilm + Sil + Qtz, is defined by the red field. Photomicrographs from the Mg-rich pelite include: F) cordierite partially replaced by pinite, G) a relict staurolite grain enclosed in garnet, and H) a pseudomorph of staurolite replaced by an intergrowth of sillimanite and spinel.

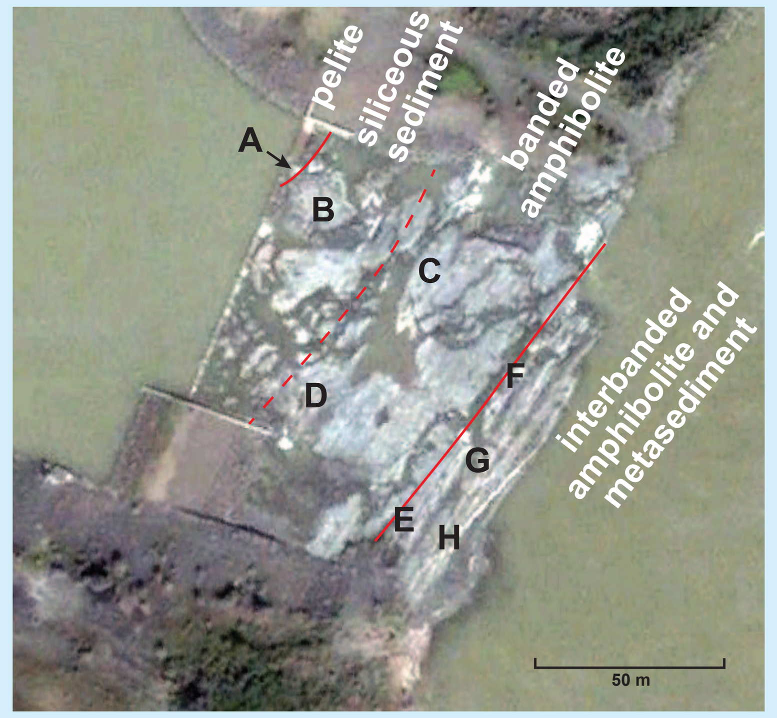




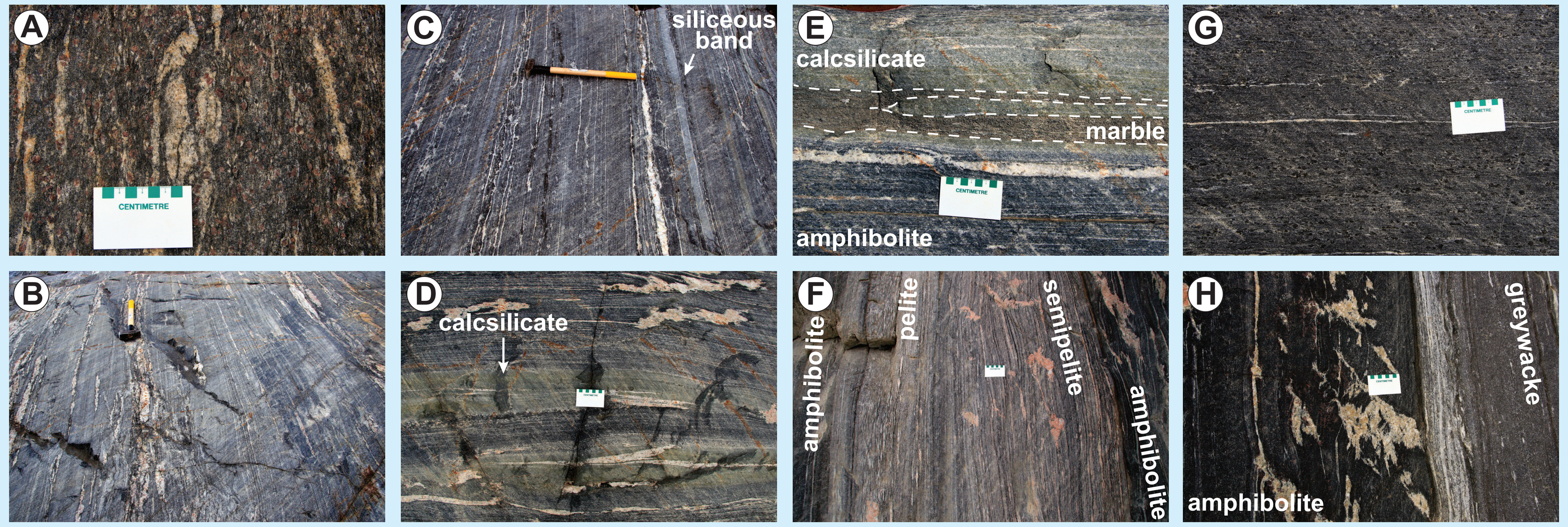
I) An overlay of equilibrium assemblage diagrams C) and E). The overlapping peak metamorphic assemblages define metamorphic conditions of approximately 680–720 °C and 4.25–5.4 kbar.

Mineral abbreviations: Amp, amphibole; And, andalusite; Bt, biotite; Cc, calcite; Chl, chlorite; Cpx, clinopyroxene; Crd, cordierite; Ep, epidote; Grt, garnet; Ilm, ilmenite; Kfs, K-feldspar; Ms, muscovite; Opx, orthopyroxene; Pg, paragonite; Pl, plagioclase; Qtz, quartz; Rt, rutile; Sc, scapolite; Sil, sillimanite; Spl, spinel; St, staurolite.

Layered mafic sequence



Aerial image of the control structure at Manasan Falls and extensive outcrops of the layered mafic sequence. The outcrop photographs to the right correspond to the locations marked on the image. The stratigraphic younging direction is not known.



A) Mg-rich pelite adjacent to the control structure. B) The siliceous sediment forms a 20 m thick sequence that grades over ~ 15 m into the banded amphibolite.

C) The banded amphibolite forms a heterogeneous sequence ~ 40 m thick. D) Calcareous and siliceous bands are common within the banded amphibolite.

E) A thin horizon of marble enclosed within a band of calcsilicate and F) siliceous pelite grading into amphibole-bearing semipelite occurs within the sequence of interbanded amphibolite and metasediments

G) and H) Local amphibolite bands associated with the metasedimentary rocks are more homogeneous suggesting they may be amphibolitized dykes.

Acknowledgements

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References

[1] Couëslan, C.G. 2011: Geological investigations in the Manasan Falls area, Thompson Nickel Belt, Manitoba (part of NTS 63P12); in Report of Activities 2011, Manitoba Innovation, Energy and Mines, Manitoba Geological Survey, in press.

[2] McDonough, W.F. and Sun, S.-s. 1995: The composition of the Earth; Chemical Geology, v. 120, p. 223–253.

[3] de Capitani, C. and Petrakakis, K. 2010: The computation of equilibrium assemblage diagrams with Theriak/Domino software; American Mineralogist, v. 95, p. 1006–1016.