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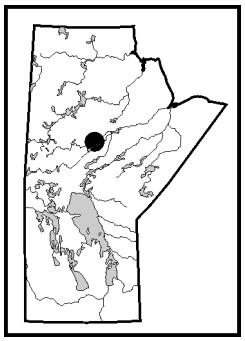
The publisher/department name in the bibliographic reference cited immediately below the title of each GS report should read **Manitoba Industry, Economic Development and Mines** instead of **Manitoba Industry, Trade and Mines**.

GS-19 Petrogenesis of the Thompson Formation T1 member, Thompson Nickel Belt, Manitoba (NTS 63P12)

by C.G. Couëslan[1]



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Summary

The Thompson Formation T1 member of the Ospwagan Group is a calcsilicate unit that has likely been derived from sedimentary rocks transitional between a 'pure' clastic system and a 'pure' carbonate system. At the Thompson mine site, it has been subjected to peak metamorphic conditions of upper amphibolite facies. There is no evidence to suggest that the T1 member has been metasomatically altered by the nearby ultramafic intrusion.

Introduction

A petrological study of the calcsilicate, or 'skarn', of the T1 member of the Thompson Formation in the Ospwagan Group was undertaken to determine the probable protolith and origin of the unit. Another aim of the study was to discern if the unit had been metasomatically affected by a nearby ultramafic intrusion. During the summer of 2002, samples of Archean gneiss, Manasan Formation M1 and M2 members, and five horizons from the Thompson Formation T1 member were collected from the Thompson South pit of Inco Ltd. The samples were sectioned and geochemically analyzed for whole-rock composition. Some sections were later taken to the Electron Microbeam Laboratory at the University of Manitoba for further study. The results of the study have been presented in fulfilment of B.Sc. thesis requirements (Couëslan, 2003).

Peak metamorphic mineral assemblages contained in all samples collected during this study indicate metamorphic conditions of mid to high grade. In addition, the occurrence of in situ anatectic melts in the M2 semipelite confirms that metamorphism attained grades in the vicinity of the second sillimanite isograd. This supports the findings of previous studies by Bleeker (1990a, 1990b) and Weber (1990), which suggested peak metamorphic conditions at the Thompson mine of 700 to 750°C and 6 to 7 kbar. The coarse recrystallization of the Manasan and Thompson formations during this metamorphic event dictate that study of the protolith and origin of these rocks must be achieved through indirect methods, including their current mineralogy and geochemistry.

Results

Examination of samples of the Manasan and Thompson formations from the Thompson pit indicate that the Thompson Formation T1 member is likely derived from a calcareous sediment (chemical deposition?), with varying amounts of clastic input. This conclusion is based on a number of changes observed in the upper portions of the directly underlying Manasan M2 member. One observation is that the Manasan Formation M2 semipelite displays an upward gradation to an increasingly 'pure' carbonate end member toward its boundary with the Thompson T1 member. This is reflected by an increase in calcium-bearing phases, such as hornblende and calcium-rich plagioclase, in samples from near the top of the M2 member, and by interfingering of calcsilicate layers heralding the change to a carbonate-dominated sedimentary facies in the overlying Thompson T1 member. The calcsilicate layers in the Manasan M2 member likely represent carbonate-bearing chemical sedimentary material deposited within an otherwise clastic-dominated system. Conversely, mica-rich layers and laminations contained within the calcsilicate of the T1 member can be interpreted as laminations of originally clastic material in a carbonate-dominated sediment.

One possible scenario is that sedimentary rocks of the M2 and T1 units are gradational between two end members: a theoretically 'pure' clastic greywacke and a pure carbonate. Geochemical scatter plots were used to test this conclusion. The premise for these geochemical scatter plots was that aluminum, which is a main constituent in clay minerals and is relatively immobile in the metamorphic environment, be used as an indicator of the quantity of clastic material in the original rock prior to metamorphic recrystallization. The scatter plots clearly show that the SiO_2 content of the samples decreases gradationally from the pure greywacke end member to the pure carbonate end member (Fig. GS-19-1), consistent with the SiO_2 being clastic in origin. Also consistent with this interpretation is a scatter plot of CaO versus Al_2O_3 revealing an inverse relationship, with calcium being enriched in the carbonate end member and depleted in the clastic end member (Fig. GS-19-2). A similar trend can be seen in plots of MgO versus Al_2O_3 (Fig. GS-19-3) and

[1] Department of Geology, Brandon University, Brandon, Manitoba R7A 6A9

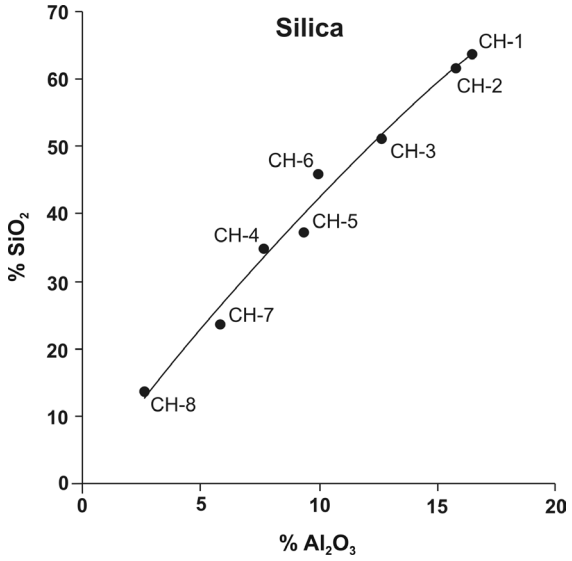

Figure GS-19-1: Geochemical scatter plot of SiO_2 versus Al_2O_3, showing the relationship between 'pure' greywacke end member CH-1 and 'pure' carbonate end member CH-8; all T1 member horizons lie between the two end members.

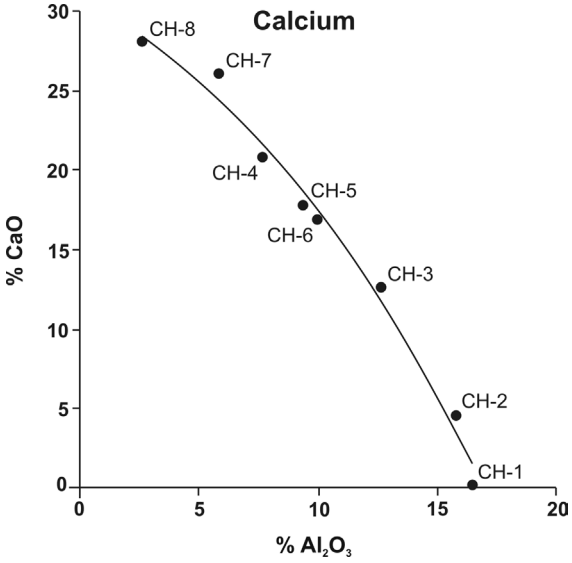

Figure GS-19-2: Geochemical scatter plot of CaO versus Al_2O_3, showing the relationship between 'pure' greywacke end member CH-1 and 'pure' carbonate end member CH-8; all T1 member horizons lie between the two end members.

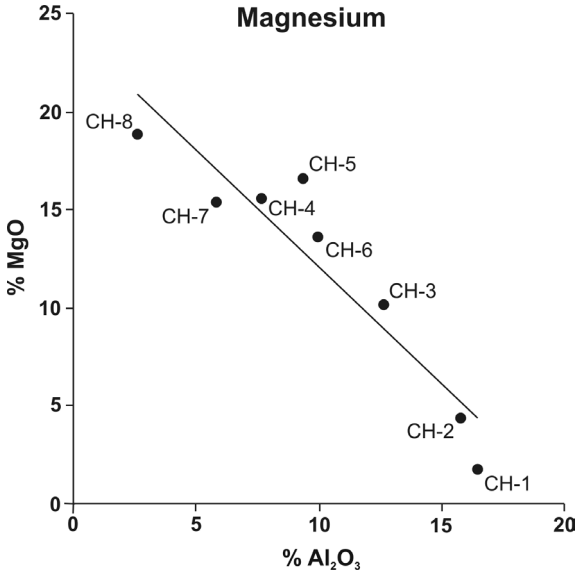

Figure GS-19-3: Geochemical scatter plot of MgO versus Al_2O_3, showing the relationship between 'pure' greywacke end member CH-1 and 'pure' carbonate end member CH-8; all T1 member horizons lie between the two end members.

volatiles (% LOI) versus Al_2O_3 (Fig. GS-19-4), with volatiles being representative of the amount of CO_2 and H_2O in the rock.

The other objective of the project was to determine whether calcsilicate rocks in the T1 member were metasomatically affected by adjacent ultramafic bodies. During this study, no conclusive evidence was found to suggest that the T1 'skarns' have been metasomatically influenced by the ultramafic body hosting the nearby Thompson nickel deposit. This does not preclude the possibility that 'skarn' samples collected from a location far removed from an ultramafic body may reveal subtle effects not recognized during this study.

Economic considerations

It is hoped that this study has created a better understanding of the Thompson Formation. This formation is an important marker horizon within the Ospwagan Group. Its stratigraphic position, underlying the sulphide-bearing horizons of the Pipe Formation P1 member, makes it an excellent indicator for potential, nearby nickel mineralization.

Acknowledgments

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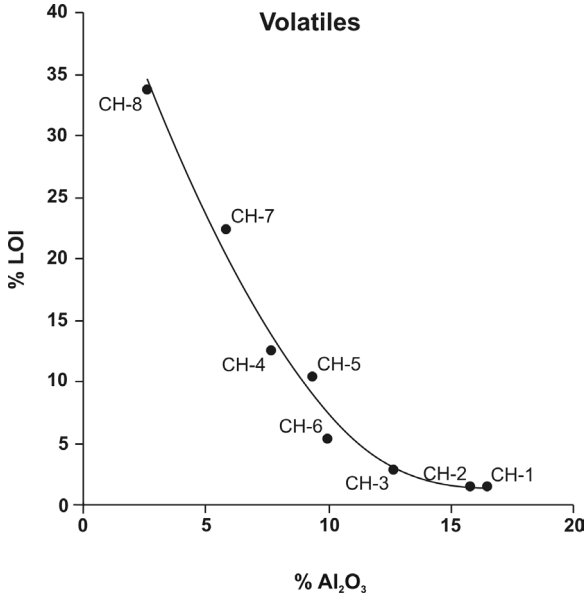

Figure GS-19-4: Geochemical scatter plot of volatiles versus Al_2O_3, showing the relationship between 'pure' greywacke end member CH-1 and 'pure' carbonate end member CH-8; all T1 member horizons lie between the two end members.