

In Brief:

- The zonation of the spodumene-bearing Cat Tail pegmatite is described
- Future work includes petrography and detailed mineral chemistry characterization

Citation:

Martins, T. and Janssens, J. 2024: Cat Tail pegmatite: zonation and mineralogy, Cat Lake area, southeastern Manitoba (part of NTS 52L11); in Report of Activities 2024, Manitoba Economic Development, Investment, Trade and Natural Resources, Manitoba Geological Survey, p. 33–37.

Summary

The Cat Tail pegmatite is located east of Cat Lake in a part of the Cat Lake–Winnipeg River pegmatite field in southeastern Manitoba. The pegmatite does not outcrop and is only known from diamond drillholes. This report presents a hand-sample description of the mineralogy and pegmatite zonation of the Cat Tail dike. The pegmatite can be divided into five zones of primary crystallization based on texture and mineralogy: border, wall, intermediate, central and quartz core. Late fracture filling and fracture-controlled replacement veinlets of spodumene that crosscut the primary zones are also visible. Interest in hard-rock lithium related to pegmatites has risen dramatically, and Manitoba is well endowed with these pegmatites and is seen as a prime location to study and explore for these types of mineral deposits.

Introduction

The Bird River domain in southeastern Manitoba has seen considerable exploration work in the last few years, particularly for spodumene-bearing pegmatites, the primary source of hard-rock lithium (Li) in the region. Global demand for battery metals, including Li, continues to be high due to the incentive to transition to a low-carbon economy. Furthermore, Canada has recognized Li to be a critical element (Government of Canada, 2024) to support economic growth, competitiveness and job creation, the advancement of reconciliation with Indigenous peoples and fostering of diverse, inclusive workplaces and communities, and to enhance global security and partnerships with allies to avoid global supply-chain disruptions (Government of Canada, 2022).

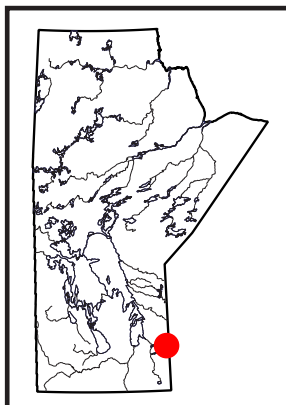
Granitic pegmatites are well known to be one of the best sources for many elements considered critical (e.g., Ta, Cs, Rb) but are particularly known for their Li enrichment (Linnen et al., 2012). Manitoba is well positioned in the supply of Li, amongst other critical elements, as demonstrated by a long history of exploration in the Bird River domain and production of spodumene concentrate from the Li-Cs-Ta (LCT)–bearing pegmatite at the Tanco mine.

The Cat Tail pegmatite is a good example of a spodumene-bearing pegmatite that was recently discovered by diamond-drilling east of Cat Lake, approximately 180 km northeast of Winnipeg, Manitoba. This report focuses on describing the zonation of the Cat Tail pegmatite from drillcore donated by W.S. Ferreira to Manitoba’s drillcore libraries in Winnipeg.

Geological setting

The Cat Tail pegmatite is considered part of the Eagle-Irgon pegmatite group of the Cat Lake–Winnipeg River pegmatite field, as defined by Černý et al. (1981). The Cat Lake–Winnipeg River pegmatite field is part of the Bird River domain of the Superior province (Figure GS2024-5-1). The Bird River domain is separated from the English River domain to the north by the Cat Lake–Euclid Lake fault and from the Winnipeg River domain to the south by the Winnipeg River fault.

An integral part of the Bird River domain is the Bird River greenstone belt, located along the southern side of the domain (Figure GS2024-5-1). The Bird River greenstone belt (BRGB) is an east-trending supracrustal belt that extends for 150 km from Lac du Bonnet in the west to Separation Lake (Ontario) in the east. The BRGB has been subdivided into two geochemically distinct sequences (northern and southern panels), both of which are composed of ca. 2.75–2.72 Ga juvenile, arc-type metavolcanic and associated metasedimentary rocks. These two panels are separated by the Booster Lake Formation (<2712 ±17 Ma; Gilbert, 2006), a turbiditic sequence with classic Bouma-type features that is considered penecontemporaneous with clastic fluvial-alluvial deposits of the Flanders Lake Formation immediately to the east (Figure GS2024-5-1; Gilbert, 2006). For a detailed geological description of the BRGB, the reader is referred to work by Gilbert and co-authors (e.g., Gilbert, 2006; Gilbert et al., 2008).



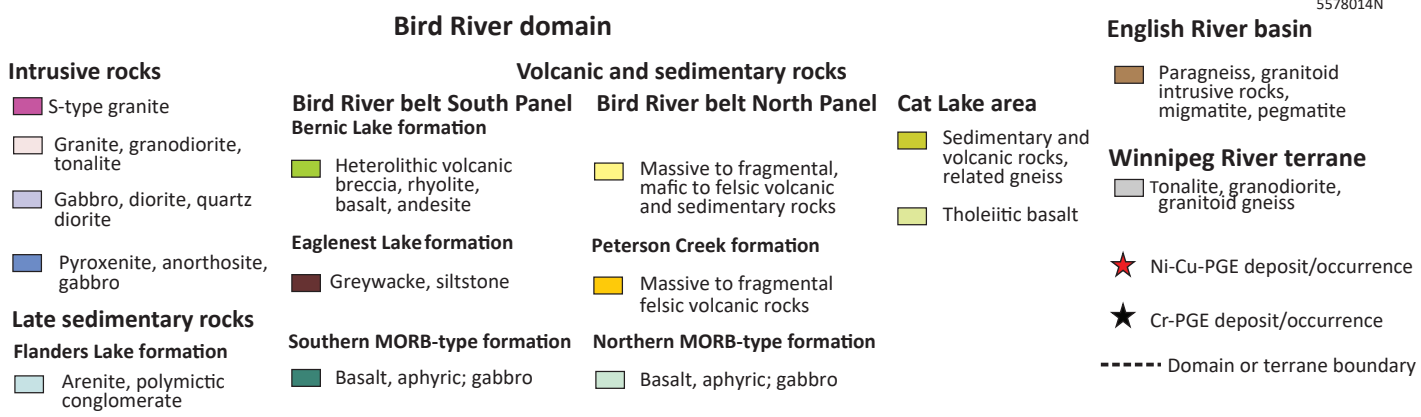
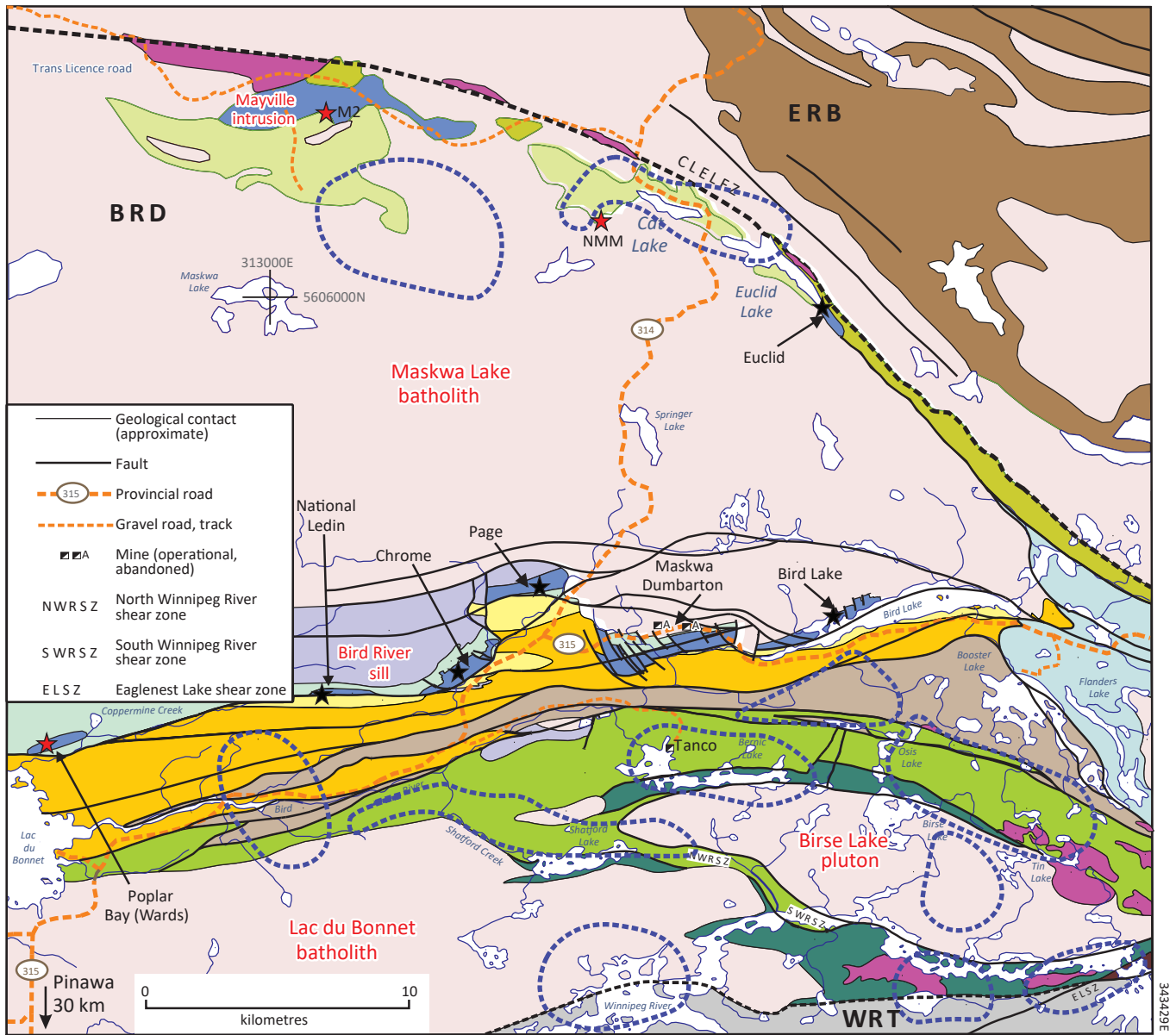


Figure GS2024-5-1: Tectonic assemblages of the Bird River domain, southeastern Manitoba (modified from Gilbert et al., 2008, 2013; Yang et al., 2013). Abbreviations: BRD, Bird River domain; CLELFZ, Cat Lake–Euclid Lake fault zone, indicated by the bold dashed line; ERB, English River basin; M2, Mayville deposit; NMM, New Manitoba mine; WRT, Winnipeg River terrane. Blue dashed lines represent location of the pegmatite groups from the Cat Lake–Winnipeg River pegmatite field (after Černý et al., 1981).

North of the BRGB, the Bird River domain consists of a granitoid terrane (Maskwa Lake batholith) that contains intrusive phases ranging from 2.85 to 2.73 Ga (Gilbert et al., 2008; Figure GS2024-5-1). This north side of the Bird River domain was ascribed to the northern limb of the BRGB by Yang and Houlié (2020). These authors described the Cat Creek–Euclid Lake area as underlain by a suite of greenstone assemblages formed in a continental-margin setting adjacent to the Mesoarchean Maskwa Lake batholith. The greenstone assemblages consist mainly of mafic–felsic volcanic and related intrusive rocks, epiclastic and minor volcanoclastic rocks, and mafic–ultramafic layered intrusions. These were intruded by younger phases of tonalite-trondhjemite-granodiorite rocks (i.e., Maskwa Lake batholith II of Yang and Houlié, 2020), late peraluminous granite and pegmatite intrusions.

Cat Tail pegmatite

The Cat Tail pegmatite was discovered in 2018 by diamond-drilling when an attempt was made to intersect a possible extension of the Irgon pegmatite. The exploration program consisted of seven NQ-size drillholes (Figure GS2024-5-2a) totalling 1256 m, with six of the holes (CT-18-01 to CT-18-06) located to target the pegmatite. The true width of the pegmatite has not been determined and it remains open at depth and along strike (Figure GS2024-5-2b; Assessment File 52L19666, Manitoba Economic Development, Investment, Trade and Natural Resources, Winnipeg). A detailed description of the discovery and detailed logs of the diamond-drill holes can be found in this assessment file. A spodumene occurrence near the pegmatite discovered by drilling was previously reported by M.G. Smerchanski in 1948 (Assessment File 98073).

The hostrocks for the Cat Tail pegmatite are a mafic volcanic unit, which locally contains holmquistite (Li-bearing amphibole) as the contact with the pegmatite is approached. The Cat Tail pegmatite can be classified as LCT complex type, rare-element class, spodumene-bearing pegmatite according to the classification of Černý and Ercit (2005). Observations for the present report were based on available sections of drillholes CT18-01 to CT-18-06 kept in Manitoba’s drillcore libraries. The drillcore was selectively sampled for thin sections for future petrographic work.

Pegmatite zonation

The Cat Tail pegmatite can be divided into five zones of primary crystallization: border, wall, intermediate, central and quartz core. Later fracture filling and fracture-controlled replacement veinlets of spodumene that crosscut the primary zones are also visible.

The border zone is pink and fine to medium grained. The primary minerals present are quartz, albite, Fe-oxides and possible columbite group minerals (CGM). Albite of the cleavelandite habit is visible throughout this zone. Small stringers of biotite measuring 1–5 cm (locally up to 30 cm) are present as xenoliths

of country rock (Figure GS2024-5-3a). Pegmatite contains a local foliation, and the pink colour is most likely due to hematization occurring locally as red veinlets that crosscut the foliation (Figure GS2024-5-3a). Hematization is not pervasive throughout the entire border zone.

The wall zone is pink and medium grained. The pink colour is due to both the presence of K-feldspar and localized hematite staining. The main minerals are quartz, K-feldspar, albite, muscovite and occasional clumps of biotite (possibly partially assimilated from the country rock). In places, a fabric is observed in the orientation of the quartz. Minor modal components include tourmaline, Fe-oxides (possibly ilmenite) and CGM.

The intermediate zone is up to 2.4 m wide (apparent width); it is medium to coarse grained with localized hematite in late fractures. Clots of the country rock are present but fewer than what is observed in the wall zone. Main mineral phases are quartz, albite, spodumene, K-feldspar and muscovite, with minor components including tourmaline, Fe-oxides (possibly ilmenite), apatite, Li-Mn-Fe phosphates and CGM. Typical primary spodumene content varies between 3 and 10% but is locally up to 25% modal content. Late veinlets of spodumene crosscut quartz and feldspars, and spodumene is also observed replacing feldspars.

The central zone is white and medium to very coarse grained, with local layers of aplite, and is variably strained, ranging from nonfoliated to intensely foliated locally (Figure GS2024-5-3b). Additionally, some areas with the coarse-grained quartz and spodumene association do not present any foliation. Bands of the aplitic texture interchange with the very coarse grained texture of the pegmatite. The aplite bands are mostly composed of albite, whereas the coarser grained bands contain mainly albite, spodumene, quartz and K-feldspar, with minor apatite and garnet. In the coarser grained layers, late spodumene veinlets surround and overprint larger crystals of quartz and feldspar (Figure GS2024-5-3b). Spodumene in the central zone is mostly white, but a light green colour variety is also present.

The quartz core zone is composed mainly of quartz with minor feldspar and a platy purple mineral tentatively identified as lepidolite. This zone is cut by spodumene and Fe-oxide veinlets.

Economic considerations

A better understanding and characterization of Li-bearing pegmatites from the Cat Lake–Winnipeg River pegmatite field further enhances the role and potential of Manitoba as a Li producer, particularly in the vicinity of the Tanco mine. Lithium is amongst the 34 elements that Canada considers critical (Government of Canada, 2024) for its potential to support Canada’s economic growth and its direct role in the green revolution (Government of Canada, 2022). Rare-element pegmatites such as the Cat Tail dike are a source of hard-rock Li that is expected to continue to grow in the future (U.S. Geological Survey, 2024). Manitoba plays an increasingly important role in the production

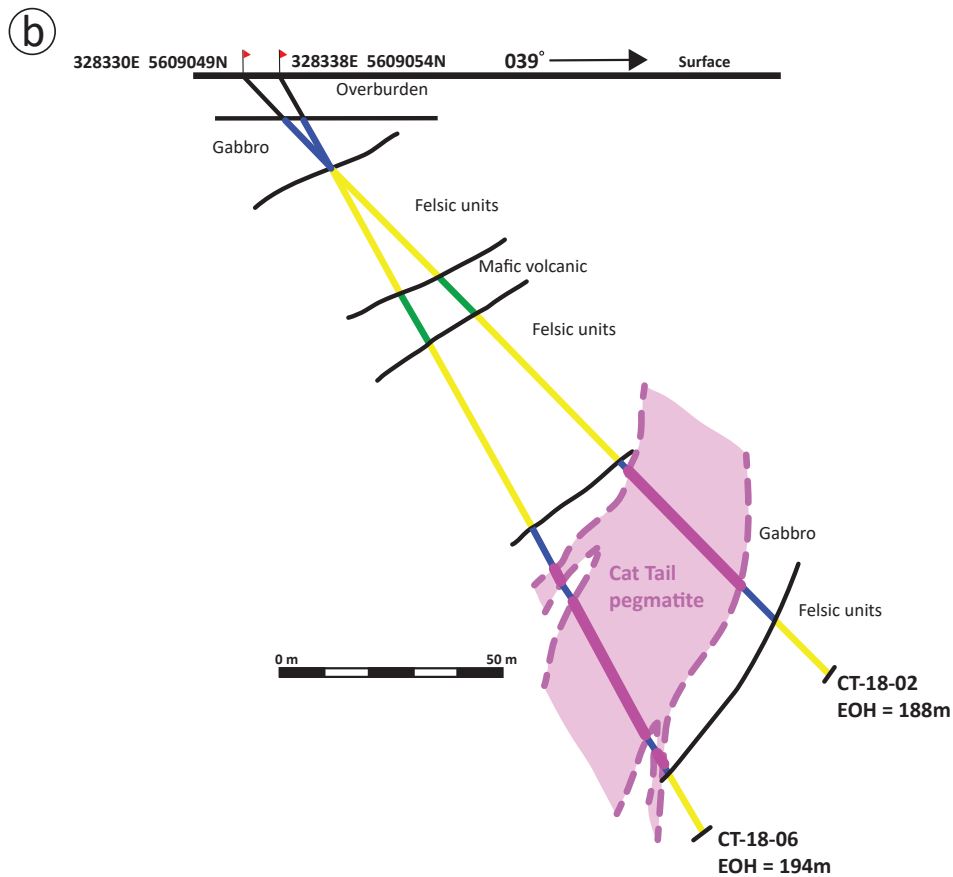
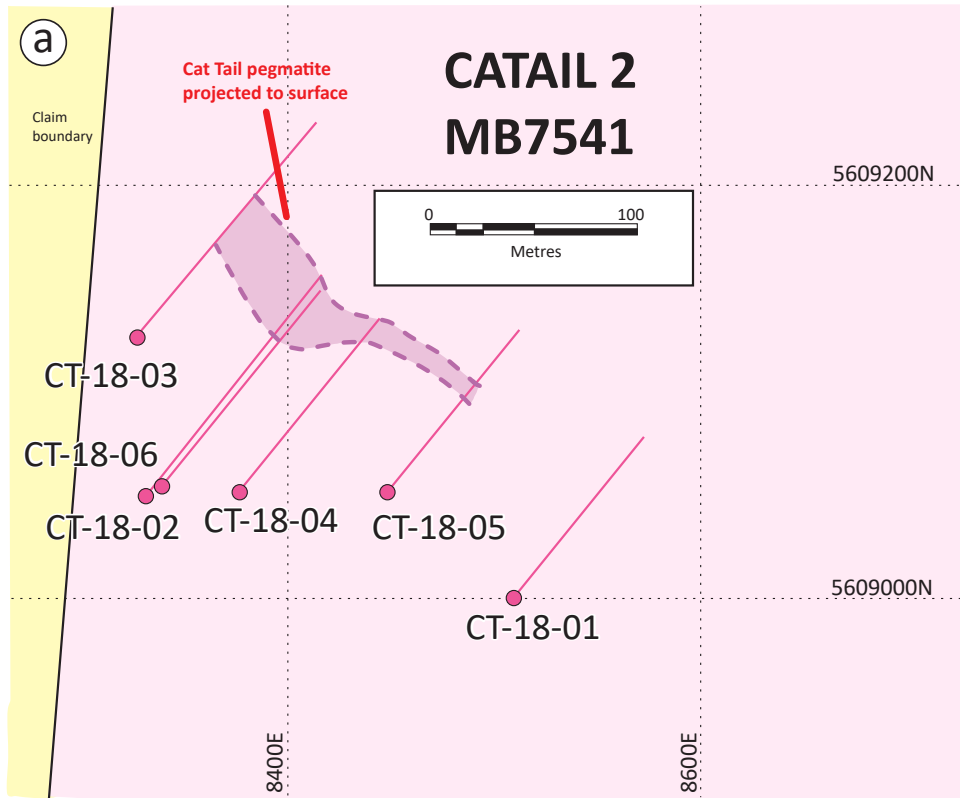


Figure GS2024-5-2: Maps showing **a)** location of drillholes within the Cat Tail pegmatite claim area, with the pegmatite projected to surface; and **b)** idealized cross-section of drillholes CT-18-02 and CT-18-06. Modified from Assessment File 52L19666 (Manitoba Economic Development, Investment, Trade and Natural Resources, Winnipeg). Abbreviation: EOH, end of hole.

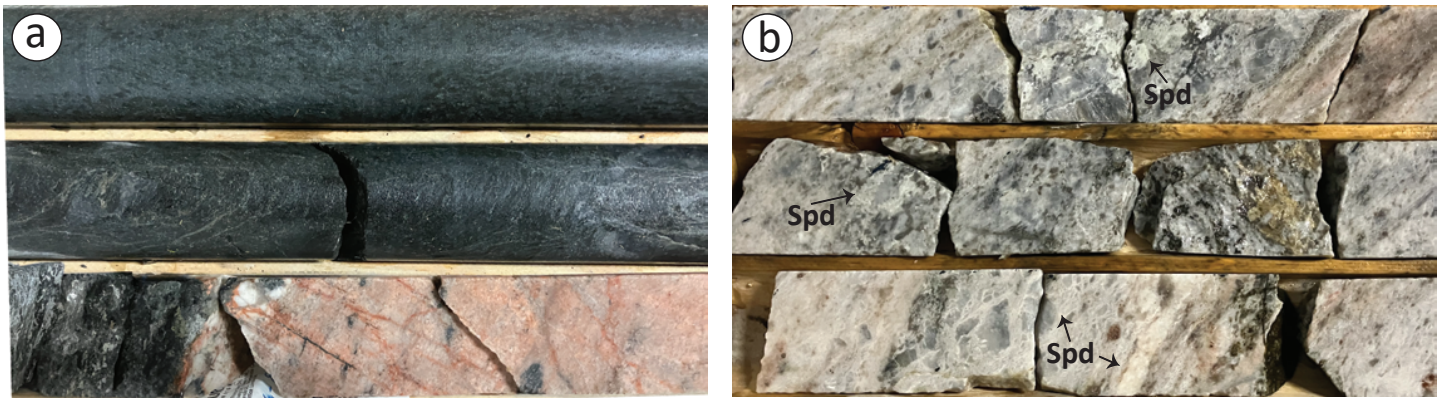


Figure GS2024-5-3: Drillcore photos of the Cat Tail pegmatite: **a)** hostrock (volcanic unit) of the Cat Tail pegmatite and pegmatite border zone with late hematite veinlets and biotite clots; **b)** central zone of the pegmatite exhibiting foliation and late spodumene replacing feldspars and in stringers surrounding larger feldspar and quartz crystals. Abbreviations: Spd, spodumene. Drillcore is approximately 47.6 mm in diameter.

of hard-rock Li with the extraction of spodumene at the Tanco mine. Future work on the Cat Tail pegmatite will include petrographic descriptions, mineralogical studies and geochronology. These data will help provide a better understating of the level of fractionation of the pegmatite and timing of emplacement, which can have implications for exploration for pegmatite-hosted Li in this part of Manitoba.

Acknowledgments

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