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GAC-MAC: FIELD GUIDE SUMMARY

Sudbury 2023: GAC–MAC–SGA Joint Annual Meeting Field Trips

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SUDBURY 2023 FIELD TRIPS OVERVIEW

This year's 2023 GAC-MAC Annual Meeting returns to Sudbury after a 24 year absence, with the Society for Geology Applied to Mineral Deposits (SGA) as a partner. Sudbury's unique location at the junction between the Archean Superior Province, Proterozoic Southern and Grenville provinces, and Paleozoic–Quaternary cover sequences, offers opportunities to attend field trips in a wide variety of geological settings from Archean greenstone belts to Proterozoic glaciogenic rift-drift sequences to Paleozoic passive platformal sequences. Sudbury also sits on the world-renowned Sudbury impact structure, is the world's premiere nickel-copper mining district, and is located within three hours drive of the prolific Abitibi-Wawa greenstone belt, which is famous for its world-class gold deposits and copper-zinc volcanogenic massive sulphide deposits. All of these add up to an impressive offering of ten pre- and post-conference field trips lasting one to four days.

Pre-Conference Field Trips

To kick-start the meeting, from May 20th to 23rd, join Stéphane Perrouty and Ross Sherlock on a four-day field trip *"Discovering the Abitibi Gold Belt"* across the Timmins, Kikland Lake, Larder Lake, Malartic, and Val-d'Or gold mining districts. This is a unique opportunity to visit many famous gold deposits, such as the Kirkland Lake, Kerr-Addison, Canadian Malartic and Sigma deposits, in a single field trip. This is a must-do for anyone interested in orogenic gold deposits.

During *"Geological Traverse of the Sudbury Impact Structure and Evolution of the Impact Melt"* on May 24th, Dustin Peters, Sandra Baurier Aymat, Shirley Peloquin, and Caroline Gordon will take participants on a one-day geological traverse across the Sudbury Structure, one of the world's oldest, largest, and best-preserved impact structures. From shatter cones and pseudotachylite bodies in the target rocks, over impact-melt related breccias and intrusions, to the world-class magmatic Ni-Cu-(PGE) sulphide mineralization, participants will be able to examine a variety of geological features that bear witness to the unique origin and complex evolution of the Sudbury Structure.

Enjoy beautiful Manitoulin Island during *"Geology of Manitoulin Island"* led by Frank Brunton, Catherine Béland Otis, Katie Hahn, and Patrick Julig. During this two-day field trip on May 23rd and 24th, you will explore the Paleozoic geology of Manitoulin and adjacent islands, including an overview of indigenous uses of local bedrock geology and a guided tour of one of Canada's oldest indigenous quarry sites. This field trip will introduce participants to one of the few places in the Great Lakes Region where Upper Ordovician and Lower Silurian sedimentary strata form prominent escarpments and cuestas. Manitoulin and surrounding islands have a distinguished paleontological and geological history, where arguably some of the first fossils were formally described in Canada, and where variably rich shelly faunas and extensive patch reef and barrier reef tracts flourished at different times proximal to Proterozoic highlands.

The sedimentology of the Huronian Supergroup will be the focus of a field trip by Patricia Corcoran and Carolyn Hill-Svehla exploring the *"Paleoproterozoic Glacial, Microbially Induced, Tidal, and Seismic Deposits of the Huronian Supergroup, Elliot Lake Region, Canada"*. This two-day trip on May 23rd and 24th will provide a detailed look at outstanding examples of ancient varves with dropstones, tillite, microbially induced sedimentary structures (MISS), flaser and lenticular beds, herringbone crossbeds, slump structures, clastic dykes, and soft-sediment deformation structures. The outcrops will provide an opportunity to discuss the factors that controlled the composition of the Huronian Supergroup formations, including the Great Oxygenation Event (GOE).

From May 22nd to 24th, Chong Ma, Lianna Vice, Carl Nagy, and Bruno Lafrance will lead participants on a three-day field trip exploring outcrops associated with *"Orogenic and intrusion-related gold mineralization in the eastern part of the Neoarchean Wawa Subprovince, Superior Province"*. This trip will emphasize the structural geological controls on gold mineralization in the Missanabie-Renabie, Dubreuilville, and Wawa gold districts of the Michipicoten greenstone belt and the Eagle River mine of the Mishibishu greenstone belt. It will provide an excellent opportunity to learn how to apply structural geology to the study of gold deposits.

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Dropstone at the contact between the Ramsay Lake mixtite and overlying Pecors Formation rhythmites of the Paleoproterozoic Huronian Supergroup. Photograph courtesy of Patricia Corcoran.

Impact-induced Sudbury breccia with Laurentian University campus in the background. Photograph courtesy of Bruno Lafrance.

Post-Conference Field Trips

End your meeting exploring and discussing new ideas on the formation of "*Base, Critical, and Precious Metals Mineralization in the Metasomatic Iron and Alkali-Calcic Systems of the Southern Province in the Sudbury Area*". This two-day field trip on May 28th and 29th will be led by Jean-Francois Montreuil, Louise Corriveau, Wyatt Bain. Metasomatic Iron and Alkali-Calcic (MIAC) mineral systems are known to be capable of forming a large suite of polymetallic mineral deposits, including Iron Oxide Copper-Gold (IOCG) deposits. Using a selection of outcrops and drill cores from a mineral exploration project located 25 km east of Sudbury, the field trip presents examples of base, critical, and precious mineral mineralization (Ni, Cu-Ag-Au, Au, Co, and REE) from showings, prospects and historic mines, including the Scadding deposit. Alteration facies and mineralization types described during the field trip illustrates the spatial and temporal linkage in MIAC mineral systems between Fe-rich to Fe-poor alteration facies, deformation and mineralization, which can be used to develop predictive mineral exploration models.

Guided in part by recently-released LiDAR digital elevation models, *"Ice on the Rocks: Quaternary Geology of the Sudbury Region"*, which is led by Riley Mulligan, Abigail Burt, Grant

Strongly-deformed gold-bearing quartz vein at the Eagle River mine of the Mishibishu greenstone belt. Photograph courtesy of Bruno Lafrance.

Clinton Group in foreground along the Niagara escarpment on Manitoulin Island. Photograph courtesy of Frank Brunton.

More than just the Big Nickel – nested and cross-cutting glacial erosional marks surrounding Sudbury's (second-most) iconic landmark tell a story of changing ice flow dynamics and directions during deglaciation. Ice flow was away from reader. Photograph courtesy of Riley Mulligan.

Sharp-walled massive chalcopyrite veins at the Podolsky North Zone in the Whistle embayment of the Sudbury Structure. Photograph courtesy of Bruno Lafrance.

Hagedorn and Andrea Marich, explores the evolution of micro- to regional-scale subglacial processes operating on Shield bedrock terrains through stops showing part of a regional moraine system, bedrock- and till-cored subglacial bedforms, and nested bedrock erosional features ranging in scale from millimetres to hundreds of metres. The one-day field trip on May 28th also provides participants with exposure to the effects of past mining and smelting practices on local landscapes as well as the region's world-class re-greening efforts.

Discover how tectonic structures form along a major geological province boundary during *"Multiscale and polyphase deformation structures in the Grenville Front Tectonic Zone near Sudbury"* led by Dazhi Jiang and Changcheng Li. During this one-day field trip on May 28th, you will visit spectacular outcrops of deformation structures including one of the world's best exposed mylonite zones. The geometry and overprinting relationships among these structures will provide you with a clear understanding of the kinematic evolution of the Grenvillian orogeny.

Building on the results of the Metal Earth program, the largest mineralization exploration project in Canada, Harold Gibson, Thomas Gemmell, Taus Jørgensen, Evan Hastie, Rasmus Haugard, and Alan Smith will lead a four-day field trip on May 28th to 31st "*Exploring Differential Metal Endowment: A comparison of the Eastern (Rouyn-Noranda) and Western (Swayze) Abitibi Greenstone Belt"*. Crustal-scale processes and features affecting metal endowment, as defined through Metal Earth's seismic, magnetotellurics, and gravity surveys, will be linked to surface geological features and crustal-scale faults. In the Swayze and Rouyn-Noranda areas the trip will focus on key outcrops, tied to a new stratigraphy, that provides insights into the differences in the magmatic and structural evolution of the ca. 2704–2695 Ma Blake River Group in both areas, their base and precious metal metallogeny, and evolution of crustal-scale faults. The trip will include a half-day visit to IAMGOLD's Côté Gold and Gosselin deposits (> 19 Moz) and explore key differences in the setting and styles of ore deposits between the western and eastern Abitibi region.

From May 28th to 30th, Henning Seibel and Michael Lesher will lead participants on a three-day trip around the Sudbury Structure in *"Sudbury Offset Dikes and Associated Ni-Cu-PGE Mineralization"*, utilizing some of the most spectacular outcrops the area has to offer. The first day will include a traverse through shocked footwall rocks, the differentiated melt sheet, and suevitic fall-back breccias associated with the Sudbury impact (visiting many of the stops of the one-day pre-meeting field trip on Sudbury) and the concentric Hess Offset dike in the North Range. The second day highlights similarities and differences between the inclusion- and sulphide-poor and inclusion- and sulphide-rich lithologies in the Trill, Worthington, Vermillion, and Copper Cliff dikes west, southwest, and south of Sudbury. The complexity and variety of barren and mineralized breccias at the contact of the former impact melt sheet with the footwall will be the focus of the last day while visiting the Whistle embayment and Whistle and Parkin dikes to the northeast of Sudbury.

Further information and registration details can be found at the Sudbury 2023 GAC-MAC-SGA website: https://event.fourwaves.com/Sudbury2023/

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