

Field trip guidebook to the geology near Merritt, south-central British Columbia, for the Citxw Nlaka'pamux Assembly

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Citxw Nlaka'pamux Assembly

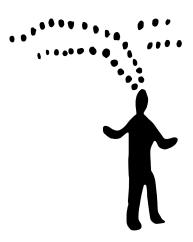
The Citxw Nlaka'pamux Assembly (CNA) was created in 2013 by the eight Participating Bands, Ashcroft Indian Band, Boston Bar First Nation, Cook's Ferry Indian Band, Coldwater Indian Band, Shackan Indian Band, Siska Indian Band, Nooaitch Indian Band, and Nicomen Indian Band. Our work is rooted in ensuring nle?képmx people have a say in decisions that matter for our people, in accordance with our values and laws. Together we will determine how to protect our culture and care for our lands, water, fish, and wildlife. Headquartered in Merritt, B.C., with a workforce of over 50, the CNA provides training and job readiness, along with cultural, social, and technical programming to the members of the eight Participating Bands. The CNA's vision is to build a legacy for our future while preserving our past.

A vital component of ensuring this occurs is the Territorial Stewardship Department. Within the Territorial Stewardship Department, the Mining and Regulatory Engagement team works side by side with the nłe?képmx (NLX) Guardians. The Guardians strive to build stronger connections amongst the territory through land-based learning and youth-elder ties. They support nłe?képmx communities in actualizing their inherent rights by being the boots-on-the-ground and eyes-and-ears to monitor record, and display self-governance over the land. The Mining and Regulatory Engagement side of the Territorial Stewardship Department ensures all mineral resource activity upholds nłe?képmx rights and title, principles, and interests. They support the Participating Bands in making informed decisions relating to mineral resource activities in the territory by clearly identifying, mitigating, and resolving potential impacts to nłe?képmx rights. This is to strengthen nłe?képmx jurisdiction within nłe?képmx territory and bring in the communities' process to the foreground of any decision-making authority.

The nłe?képmx Nation is comprised of 15 contemporary rights-bearing Bands or First Nations with approximately 6,500 members, of which the Citxw Nlaka'pamux Assembly represents 8 of. nłe?képmx is the linguistic spelling of the word "Nlaka'pamux".

The nle?képmx territory generally extends through-out the south-central interior of British Columbia, along the Fraser River from Sawmill Creek (south of Spuzzum), north along the Fraser River to Texas Creek (south of Lillooet), including all watersheds that flow into Fraser River between these two posts, the Nahatlatch watershed, and from Battle Creek, Stein Valley west, from Lytton to Ashcroft along the Thompson River, including all watersheds that flow into Thompson River between these two posts, Upper Hat Creek to Cache Creek, the whole of the Nicola Valley, including the watersheds that flow into the Nicola Lake, north of the Tunkwa Lake area to the south edge of Kamloops Lake east to the western edge of Okanagan Lake, the Coquihalla watershed just east of Hope, the upper Similkameen river basin to Hedley, the upper Skagit River and upper Nooksack River watersheds in northern Washington State from Mount Baker east through-out the Cascade Mountain Range in northern Washington State to the area south of the Cathedral Lakes.

The territory encompasses everything within this area, from the middle of the earth to the top of the sky. All the resources within the territory were placed there by the Creator for the use by the nłe?képmx and are integral to the social, economic, and cultural values and identities we hold as nłe?képmx people.



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Summary

This professional development field trip for the Territorial Stewardship staff of the Citxw Nlaka'pamux Assembly focusses on the geology near Merritt. Our laboratory will be the traditional territory of the eight Participating Bands represented by the Citxw Nlaka'pamux Assembly. On this field trip we will examine porphyry-related mineral occurrences at five sites. The first day will be spent looking at rocks near the former Craigmont mine and the current New Craigmont exploration project (Nicola Mining Inc.). On the second day we examine rocks at the MDP exploration project (Kodiak Copper Corp.).

Keywords: Citxw Nlaka'pamux Assembly, Merritt, porphyry deposits, skarn deposits, Quesnel terrane, outreach, engagement.

1. Introduction

Learning about and understanding the geological processes that shape our Earth, of relevance to us all, is best addressed on the land and outside of a classroom. This professional development field trip for the Territorial Stewardship staff of the Citxw Nlaka'pamux Assembly focusses on the geology near Merritt. Our laboratory will be the traditional territory of the eight Participating Bands represented by the Citxw Nlaka'pamux Assembly. Rooted in respect and partnership, together we will examine geological processes that led to the environment we live in. We will also highlight the interplay between geological processes and the human activities that modify the land, including historical and recent interest in mineral resources and how modern exploration projects function

Of particular importance to the interior regions of south-central British Columbia are porphyry deposits, which form when one tectonic plate slides beneath another to depths where high temperatures cause melting. The hot buoyant magmas generated by this melting scavenge metals and rise into the overlying crust to re-solidify at relatively shallow levels to form 'igneous intrusions' that get chemically altered by circulating hot waters. Commonly related to porphyry deposits are skarn deposits, which consist of minerals that form by alteration and replacement processes driven by the circulation of hot metal-bearing magmatic fluids that have infiltrated surrounding country rocks. Porphyry deposits are commonly rich in copper and/or molybdenum and contain appreciable gold and silver. They may also contain other minor metals that could be recoverable as by-products (companion metals) such as the

platinum group elements (PGE), rhenium, and tellurium and, in the more molybdenum-rich porphyry deposits, beryllium, bismuth, lithium, niobium, the rare earth elements (REE), tantalum, tin, and tungsten. Different varieties of skarn deposits are classified based on the predominant metal and include copper, iron, lead-zinc, tungsten, gold, molybdenum, and tin.

On this field trip we will examine porphyry-related deposits at five sites (Figs. 1, 2). The first day will be spent looking at rocks near the former Craigmont mine and the current New Craigmont exploration project (Nicola Mining Inc.). On the second day we examine rocks at the MDP exploration project (Kodiak Copper Corp.).

2. Geological setting

The mineral endowment of British Columbia, including the area near Merritt, is intimately tied to the tectonic evolution of the Canadian Cordillera, the system of mountain ranges that includes most of British Columbia, Yukon, and Alaska (Fig. 1). The Canadian Cordillera is made up of pieces of crust referred to as 'terranes', many of which did not originally belong to North America, in some cases having travelled from 1000s of km away. Some were once underwater volcanoes or small continents, or parts of an ancient ocean floor. Many were stuck onto or 'accreted' to what was then the western flank of North America between about 250 million and 50 million years ago during the Triassic, Jurassic, and Cretaceous parts of the Mesozoic Era (Fig. 3). This accretion records terrane collisions that were driven by the westward motion of the North American continental plate.

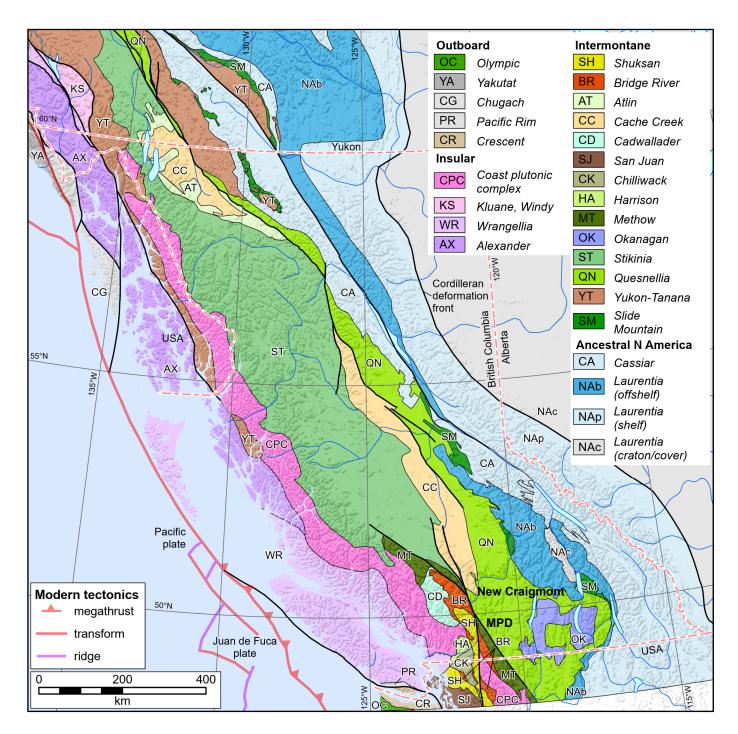


Fig. 1. Superterranes, terranes, and modern tectonic elements of the Canadian Cordillera in British Columbia. General location of New Craigmont and MDP exploration projects in Quesnel terrane (Quesnellia). Modified after Colpron (2020).

About 1.8 billion years ago, the eastern part of what is now British Columbia included the western edge of Laurentia, which formed the nucleus of the Canadian Shield. Plate tectonic processes led to old continental landmasses (cratons) like Laurentia to assemble into a supercontinent called Rodinia by about 1.1 billion years ago. In turn, the protracted breakup of Rodinia, which extended from about 1400 to 500 million years ago (Mesoproterozoic to Neoproterozoic, Fig. 3), culminated

in continental splitting and opening of a vast version of the Pacific Ocean (Panthalassa). Since then, the geologic record is one of continental accretion in which terranes amalgamated with each other and with the western flank of the Laurentian continental margin ('Ancestral North America', Fig. 1). This accretion continues today as the modern Pacific Ocean closes due to oceanic crust of the Juan de Fuca plate sliding beneath Vancouver Island in a process called subduction.

Fig. 2. Highway map of field trip stops.

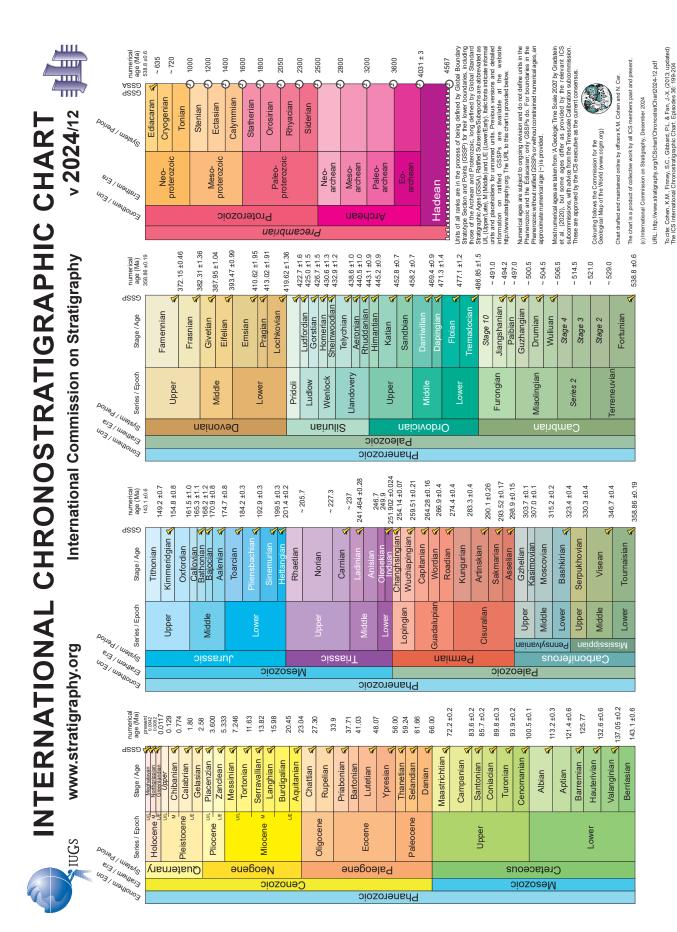


Fig. 3. International Union of Geosciences (IUGS), International Commission on Stratigraphy (ICS) International Chronostratigraphic Chart, version 2014/12. From Cohen et al. (2013, 2024).

The current Cascade volcanic arc, which includes Mount Meager and Mount Garibaldi on the southwest mainland, is a direct result of this subduction process. During continental accretion processes, many rocks with original parallel layering got squeezed to create fold patterns and large crustal blocks moved with respect to one another along breaks called faults. Similarly, many rocks were subjected to high temperatures and/or pressures (metamorphosed).

Each terrane has its own geological history and characteristic mineral deposits (e.g. Nelson et al. 2013; Hickin et al., 2017). The terranes are commonly grouped into superterranes: (from east to west) Ancestral North America, Intermontane, Insular, and Outboard (Fig. 1). Ancestral North America consists of sedimentary rocks that were deposited on the western flank of the rifted supercontinent. The Intermontane superterrane consists of a diverse group of volcanic and sedimentary assemblages and kindred igneous intrusive rocks that mainly formed in and adjacent to island arcs outboard of Ancestral North America in the Panthalassic Ocean, where oceanic crust subducted beneath oceanic crust. The Insular superterrane consists of similar island arc terranes and voluminous granitic complexes formed by younger accretionary, collisional, and post-collisional processes. The Outboard superterrane includes older accreted terranes and the present day Cascadia subduction

zone. Modern-day volcanic complexes related to Cascadia subduction are distributed along the length of the western Cordillera, and many of the terranes are partially covered by sedimentary rocks that were deposited during terrane accretion and collision, when older rocks were deformed, uplifted, eroded, and redeposited in newly created sedimentary basins. As with many parts of the world, the Canadian Cordillera was covered by glaciers multiple times in the last 2.6. million years (Quaternary, Fig. 3). Much of the landscape bears witness to these glaciations in the form of sculpted bedrock and glacial, fluvial, lacustrine, and eolian deposits related to ice advances and retreats (e.g., Hickin et al, 2017).

The New Craigmont and MPD exploration projects are in the Intermontane superterrane in what is referred to as Quesnel terrane or Quesnellia (Fig. 1). The Nicola Group of volcanic and sedimentary rocks, which were deposited between 227-201 million years ago (Mihalynuk et al., 2025), and related igneous intrusions (e.g., Guichon Creek batholith), are the defining geologic units in Quesnellia (Fig. 4). Porphyry and porphyryrelated deposits in southern Quesnel terrane have contributed significantly to copper, gold, and molybdenum production in the province (e.g. Logan and Mihalynuk, 2014; Mihalynuk and Diakow, 2020; Mihalynuk et al., 2025).

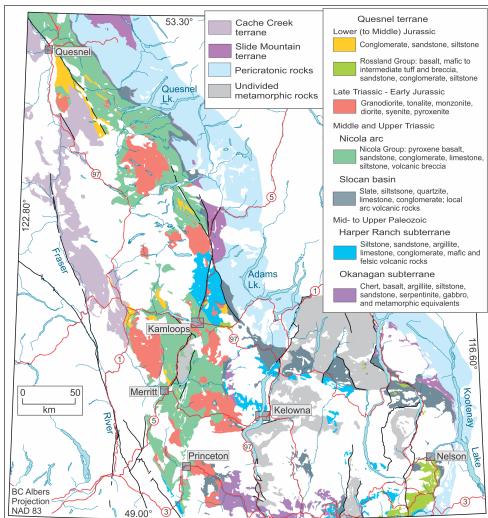


Fig. 4. Generalized geology of southcentral British Columbia highlighting rock units in Quesnel terrane. Upper Triassic-Lower Jurassic intrusions shown only where they cut the Nicola Group. Uncoloured areas mainly Middle Jurassic to Recent intrusive, volcanic and sedimentary rocks, but may include older rocks of uncertain correlation. After Schiarizza (2019).

3. Road log

Day 1: former Craigmont mine and New Craigmont exploration project, Nicola Mining Inc.

Starting from the Citxw Nlaka'pamux Assembly office (1840 Nicola Avenue, Merritt), drive northwest on the Merritt-Spences Bridge Hwy (BC-97C). After 4.8 km, stay in the left lane and continue for 3.6 km. Turn right onto Aberdeen Rd, and continue for 6.4 km. Turn left to access the Nicola Mining Inc. gate. Pass the gate and proceed to the New Craigmont office (UTM Zone 10 U, 650241 E, 5562915 N) for everyone to sign in. From the office, take the old open pit service road north for 12.7 km to Stop 1 (Fig. 5).

The former Craigmont mine was developed on a series of

Cu-Fe skarn orebodies at the contact between Upper Triassic volcanosedimentary rocks of the Nicola Group and the Guichon Creek batholith (Late Triassic to Early Jurassic). Currently, the New Craigmont exploration project is examining porphyry Cu targets related to Guichon Creek batholith intrusive units in addition to the historic Cu-Fe skarn mineralization. In 2024, Nicola Mining Inc. conducted an IP survey that extended across approximately 6.5 km² over the Marb-Cas zone, which we will visit, and the West Craigmont, and Embayment zones. Diamond drilling (14 holes, 4872 m) was designed to test geophysical and geological targets in the contact zone between volcanic and intrusive rocks (Clarke et al., 2025; Pothorin, 2025).

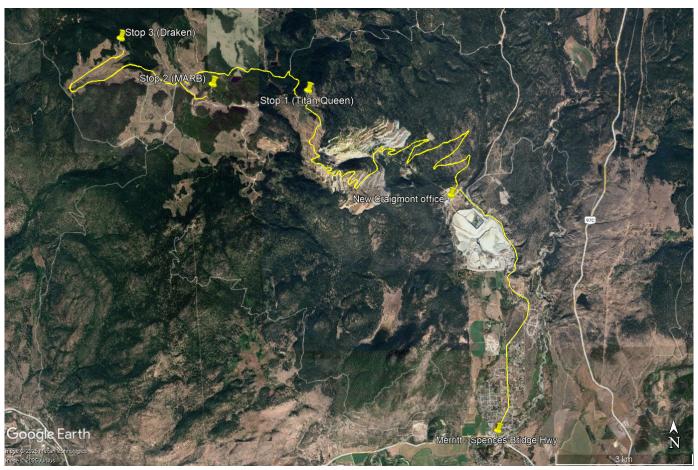


Fig. 5. Satellite detail and route to New Craigmont exploration project field sites (Stops 1, 2, and 3).

Stop 1 (Titan Queen zone; UTM Zone 10 U, 647036 E, 5565049 N)

This is series of trenches north of the road at 647017, 5564990 (Fig. 6) cut into volcanic rocks of the Nicola Group close to the contact with rocks of the Guichon Creek batholith. In the trenches is a series of northeast-trending, steeply dipping highly altered and mineralized zones 1-10 m wide. These zones are considered a form of skarn type of mineralization, possibly representing a cap developed above a barren Guichon Creek diorite intrusion. The Nicola Group rocks are dark, massive,

moderately magnetic, and dense and display strong chlorite and epidote alteration. The skarn zones contain magnetite, quartz, chalcopyrite, bornite, tourmaline, and copper-oxide minerals such as malachite and azurite (Fig. 7).

Continue north and west for 4.5 km along the old open pit service road to Stop 2 (Fig. 5).



Fig. 6. Stop 1. Trench approximately 20 m north of the road. Altered Nicola Group rocks in contact with Guichon Creek batholith rocks.



Fig. 7. Stop 1. Altered Nicola Group with malachite (green) and azurite (blue) copper oxides.

Stop 2 (MARB zone; UTM Zone 10 U, 644989 E, 5565161 N)

Large open area with Guichon Creek batholith outcrops (Figs. 8, 9) and inclusions of Nicola Group rocks (Fig. 10). The batholith outcrops are medium- to coarse-grained, equigranular diorites composed of plagioclase, quartz, and biotite. Nicola Group volcanic rocks are exposed in a series of trenches within 10s of metres of Guichon Creek batholith outcrops. The trenches expose massive, basaltic andesite volcanic rocks.

Altered patches containing epidote and biotite are distributed preferentially adjacent to fractures. Both Guichon Creek batholith and Nicola Group rocks show incipient mineralization represented by scarce chalcopyrite and surficial copper oxide expressions. Two fine-grained northwest-trending diorite dikes (~5 m wide) crosscut Nicola Group volcanic rocks.

Continue west for 5.0 km along the old open pit service road to Stop 3 (Fig. 5).



Fig. 8. Stop 2. Guichon Creek batholith border phase with inclusions of Nicola Group rocks. Yellow square denotes area of Figure 9.



Fig 9. Stop 2. Guichon Creek batholith medium-grained diorite.



Fig. 10. Stop 2. Trench cutting dark-toned Nicola Group basaltic andesite near the contact with Guichon Creek batholith.

Stop 3 (Draken zone UTM Zone 10U, 642737 E, 5566341 N)

In 2021, this site experienced an intense fire, which revealed several large outcrops scattered on a glacially sculpted topographic high (Fig. 11) of Guichon Creek batholith border phase diorite. The rock is light-colored, medium- to coarsegrained, and composed of mainly quartz, plagioclase, and biotite. Several sets of veins are present, containing quartz and potassic feldspar (Fig. 12a) and minor amounts of hematite and trace malachite along vein margins. Some areas show intense hydrothermal alteration around fractures, resulting in patches of epidote (Fig. 12b). In some portions, quartz and potassic feldspar pegmatitic bodies are present (Fig. 12c), with local molybdenite within potassic feldspar veins (Fig. 12d). One of the vein sets (trending ~320°) is more oxidized and contains more copper oxide. Veins commonly display apparent offsets up to 1 m along late-stage fractures.

Return to New Craigmont office. Take Aberdeen Rd for 6.3 km and turn left at Merritt-Spences Bridge Hwy (BC-8 W/BC-97C). Continue for 8.7 km to Citxw Nlaka'pamux Assembly office (1840 Nicola Avenue).



Fig. 11. Stop 3. Glacially sculpted Guichon Creek batholith border phase medium-grained diorite in 2021 burn.

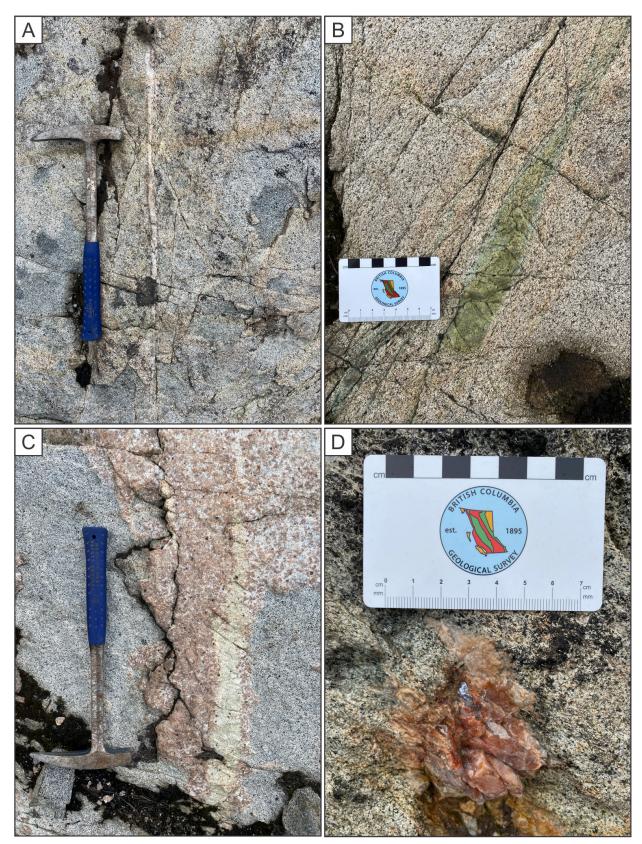


Fig. 12. Stop 3. Detailed characteristics of Guichon Creek batholith border phase diorite. a) Medium-grained diorite displaying 'salt and pepper' texture (black and white dotted rock) cut by 1-cm wide quartz vein bordered with potassic feldspar. b) Epidote hydrothermal alteration in fractured portion of the diorite. c) Quartz and potassic feldspar pegmatite (rock with large crystals) in diorite. d) Potassic feldspar vein cutting Guichon Creek border phase diorite with molybdenite (molybdenum sulfide; silver speck in the center of the photo).

Day 2: MPD project, Kodiak Copper Corp.

Starting from the Citxw Nlaka'pamux Assembly office (1840 Nicola Avenue, Merritt), drive southeast on the Merritt-Spences Bridge Hwy (BC-97C). After driving 42.3 km, take the Loon Lake Road exit. Turn right at km 0 of the Shrimpton forest service road (Fig. 13). Turn right at km 15.2. Turn left at km 16.2. Turn left at km 16.7. Drive km 19.7 to Stop 4 (Prime zone of the MPD exploration project).

The MPD project area is mainly underlain by volcanosedimentary rocks of the Nicola Group. Bedrock is commonly buried by glaciofluvial deposits, which can be an impediment to exploration. The MPD project comprises a series of porphyry Cu-Au targets, including the Prime/Gate zone (see below), and the Man, Dillard, Ketchan, South, West, and Adit zones. The Prime and Gate zones are mainly underlain by phyric volcanic flows and pyroclastic rocks composed of pyroxene, amphibole, and feldspar. These rocks are cut by dikes of mediumgrained porphyritic diorite, monzonite, and syenite. These dikes are variably altered and may contain copper and gold mineralization. Locally, the rocks are tilted and folded. Steeply dipping brittle fault zones are common, alongside brecciated zones and local slickenside fracture surfaces. Copper-gold mineralization occurs as disseminations and fracture-filling sulfides hosted by altered porphyritic diorite and intermediate and mafic volcanic host rocks.

Between 2019 and 2025, Kodiak Copper Corp. drilled about 89,000 m in 194 holes, collected about 8,500 soil samples and 660 rock samples, and completed about 170 m of trenching and 250 km of induced polarization (IP) geophysical surveying (Clarke et al., 2025; Pothorin, 2025).



Fig. 13. Satellite detail and route to MPD exploration project field sites (Stops 4 and 5).

Stop 4 Prime zone; MDP project (Kodiak Copper Corp.)

Historic Prime NE trench area from 1960s. Diorite breccia in fault contact with andesite. Intermediate volcanic rock with sulfides (pyrite and chalcopyrite) and copper oxides (malachite) near fault zone (Fig 14). Re-sampling by Candorado/GWR Resources in 2010 returned 0.89% Cu and 0.27 g/t Au along a length of 20 m (including 1.39 g/t Au along 2 m). The trench was subsequently drilled in 2010 and returned values of 68 m 0.13% Cu and 0.05 g/t Au and 36 m of 0.15% Cu and 0.05 g/t Au.

Drive for another 850 m to Stop 5 (Gate; Fig. 13).

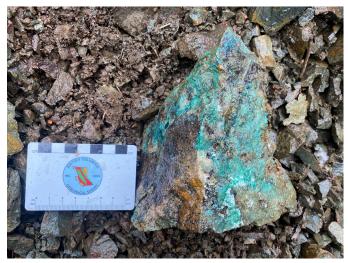


Fig. 14. Stop 4. Nicola Group volcanic rock with malachite (copper oxide).

Stop 5 Gate zone; MDP project (Kodiak Copper Corp.)

The west side of the road cut (Fig. 15) and several historic trenches nearby are represented by intrusive diorite with sparse gossan cut by potassic feldspar veins and mafic and intermediate volcanic rocks with surface copper oxide (Fig. 16). Across the road, monzonite dikes cut andesite with weak potassic alteration and minor chalcopyrite. Chips along a road cut yielded up to 0.47% Cu in a 2.5 m section, included within a 7.5 m section averaging 0.26% Cu and 0.17 g/t Au. Mineralization consists mostly of malachite after bornite and chalcopyrite.

Several drill holes in this area tested shallow geophysical IP chargeability anomalies. This area is part of the 'pyrite shell' on the north periphery of the Gate zone Cu mineralization. The Gate zone starts just to the south of the area and has been drilled southward.

Retrace route to return to Citxw Nlaka'pamux Assembly office.



Fig. 15. Stop 5. Diorite cut by mafic volcanic rocks (see different shades of brown).

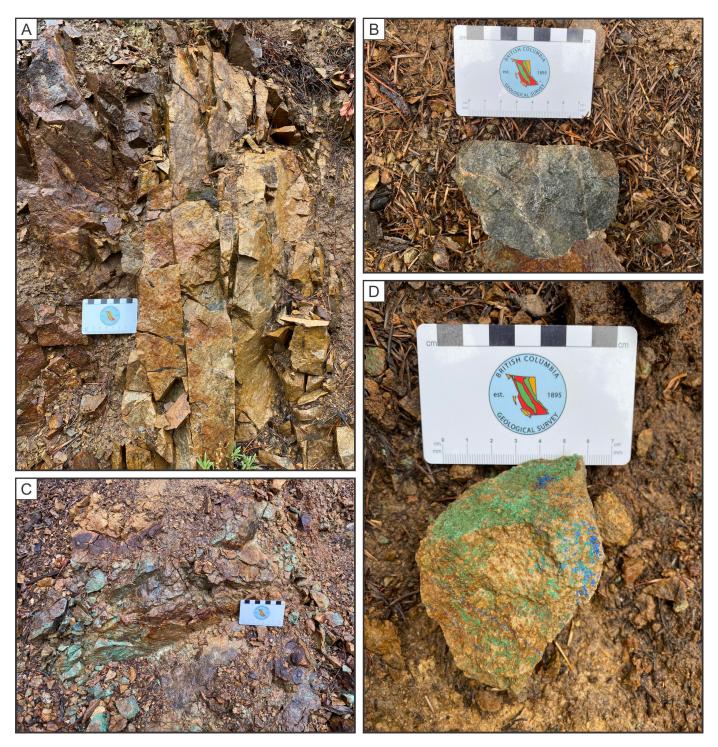


Fig. 16. Stop 5. a) Diorite (right side of photo) in contact with mafic volcanic rock (left side of photo). b) Medium-grained diorite. c) Mafic volcanic rock with surface copper oxide stain. d) Strongly altered volcanic rock with copper oxides malachite (green) and azurite (blue).

Bacha

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