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Overview of the Atlin Integrated Geoscience Project, northwestern British Columbia, year three[1]

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Abstract: The Atlin Integrated Geoscience Project, jointly funded by federal and provincial governments, entered its third and final year in 2002–2003. It is designed to advance understanding of the geological evolution and mineral potential of the northern Cache Creek terrane.

Project accomplishments for year three include 1) characterization of Cache Creek Group biostratigraphy and tectonostratigraphy; 2) new surficial geology map outlining placer potential in the Atlin area; 3) improved understanding of the age, composition, emplacement, and metallogenic potential of Mesozoic plutonic rocks; 4) better definition of the distribution and paleoenvironment of Neogene volcanism; 5) delivery of a one-day workshop on magnetic surveying to prospectors and the general public.

High-grade copper mineralization was discovered by personnel from the provincial survey. The discovery, named Joss'alun, is hosted within oceanic crustal rocks of the Cache Creek terrane. Mineralization appears concordant with the enclosing volcanic stratigraphy. If syngenetic, it establishes the terrane's volcanogenic massive sulphide potential.

Résumé : Le projet d'Atlin de l'Initiative géoscientifique ciblée, dont le financement est assuré conjointement par les gouvernements fédéral et provincial, en est à sa troisième et dernière année en 2002-2003. Il vise a améliorer notre compréhension de l'évolution géologique et du potentiel minéral de la partie nord du terrane de Cache Creek.

Pendant les trois années du projet il a été possible 1) de caractériser le Groupe de Cache Creek des points de vue biostratigraphique et tectonostratigraphique; 2) de dresser une nouvelle carte géologique des matériaux superficiels délimitant les aires potentielles de placer dans la région d'Atlin; 3) d'améliorer notre compréhension de l'âge, de la composition, de la mise en place et du potentiel métallogénique des roches plutoniques du Mésozoïque; 4) de mieux définir la distribution et le paléoenvironnement du volcanisme néogène; 5) de tenir un atelier d'une durée d'une journée sur les levés magnétiques à l'intention des prospecteurs et du grand public.

Une minéralisation cuprifère à haute teneur a été identifiée par le personnel des services géologiques provinciaux. Cette minéralisation, à laquelle a été attribué le nom de Joss'alun, est encaissée dans les roches de croûte océanique du terrane de Cache Creek. Par rapport à la stratigraphie volcanique encaissante, la minéralisation semble présenter une relation de concordance. Si elle se révèle syngénétique, ceci établirait pour le terrane un certain potentiel quant aux minéralisations de sulfure massifs volcanogènes.

[1] Contribution to the Targeted Geoscience Initiative (TGI) 2000–2003.

INTRODUCTION

The Atlin Integrated Geoscience Project is a three-year initiative designed to advance understanding of the geological evolution and mineral-resource potential of the northern Cache Creek terrane (Fig. 1; Lowe and Mihalynuk, 2002; Mihalynuk and Lowe, 2002). It was launched in 2000 with the collection of aeromagnetic data funded by the federal Targeted Geoscience Initiative (TGI). In 2001, matching funding from the British Columbia Geological Survey Branch permitted systematic 1:50 000 scale bedrock mapping in the southern project area (Nakina transect, Mihalynuk et al., 2002) and facilitated follow-up, ground-based magnetic and reconnaissance geological surveys of postaccretionary plutonic bodies (Lowe and Anderson, 2002) as well as detailed investigations of mafic volcanic suites within the Cache Creek complex (English et al., 2002). This work was conducted in partnership with geoscientists from Canadian and European universities and was enhanced by geochemical, isotopic, biogeochronological, and biostratigraphic studies.

The 2002 field season was the second and final one of the project. Bedrock mapping was completed in map area NTS 104 N/2 and approximately 75% of NTS 104 N/3 (mapping in NTS 104 N/1 was completed in 2001). Supported topical studies include detailed paleontological and biostratigrapic studies of sedimentary and volcaniclastic rocks within the Cache Creek complex and an assessment of hydrocarbon potential within the Whitehorse Trough (Fig. 2). Mapping and sampling of Mesozoic plutonic rocks in the central and northern Atlin map area and geological and magnetic analyses of ultramafic rocks in the Nahlin ultramafic body were also undertaken (Fig. 2). An investigation of the distribution and paleoenvironment of Neogene volcanism in the project area was initiated in the Llangorse volcanic field, central project area (Fig. 2). This paper outlines each of these activities and summarizes research that in many cases is preliminary. Brief overviews of non-field related activities are also provided.

BEDROCK MAPPING IN THE NAKINA TRANSECT

Geological mapping in 2002 focused on map areas NTS 104 N/2W and 3 (Fig. 3), a westward extension of 2001 mapping. From east to west, 2002 mapping crossed four main northwest-trending belts, i.e. a platformal carbonate belt (Merran, 2002), a chert- and basalt-dominated belt, a serpentine

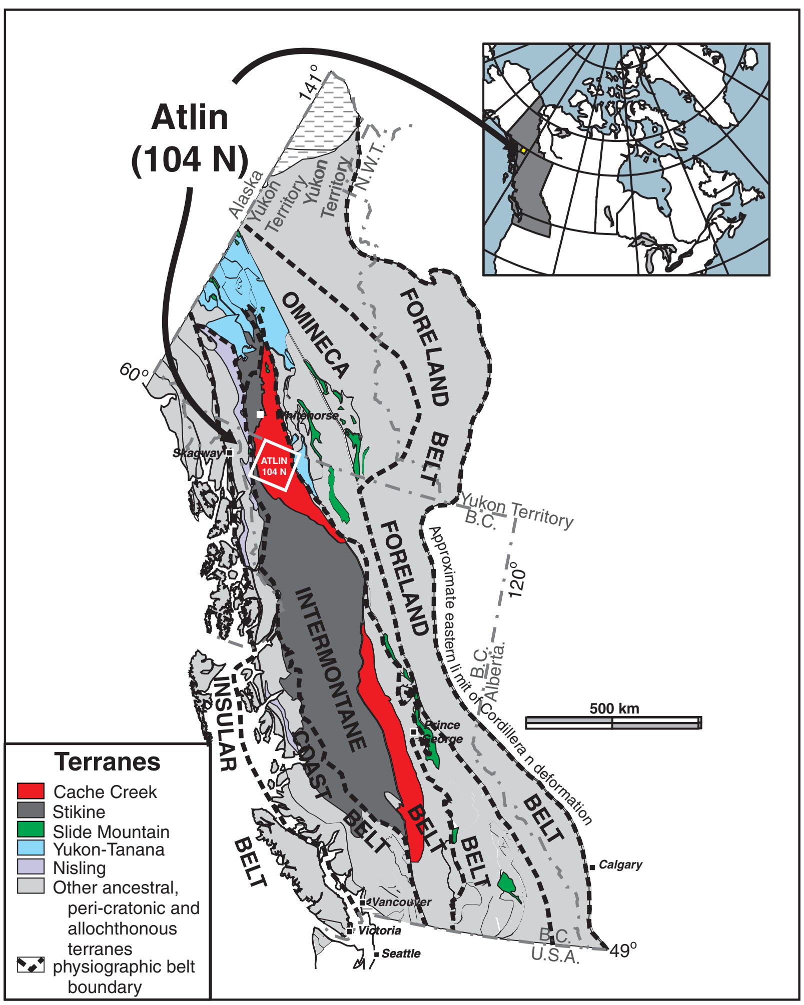

Figure 1.

*Terrane map of the Canadian Cordillera (*modified from *Wheeler et al., 1991) showing the location of the Atlin Integrated Geoscience Project area.*

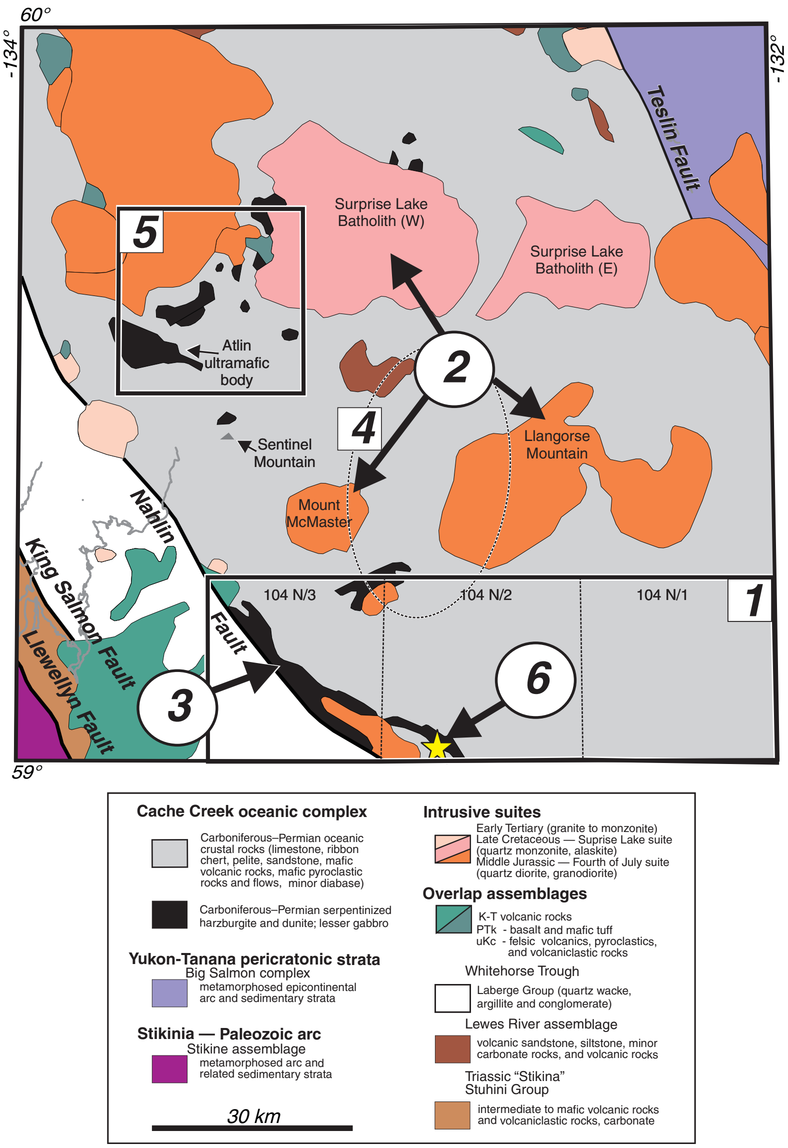

Figure 2.

Generalized geology of the Atlin map area (modified from *Mihalynuk et al., 1996). 1, bedrock mapping, Nakina transect; 2, plutonic studies; 3, Nahlin ultramafic body; 4, Llangorse volcanic field; 5, surficial geology and placer studies; 6, Joss'alun mineral discovery.*

mélange belt, and a belt of turbiditic clastic rocks of the Laberge Group that is separated from the other three by the Nahlin Fault (*see* Mihalynuk et al., in press; English et al., in press). The three eastern belts are part of the Cache Creek oceanic complex (Fig. 2).

Eastern carbonate belt

The northern margin of the carbonate belt (along and north of Taysen Creek, Fig. 3) is characterized by extreme structural complexity with several excellent exposures of thick-bedded white carbonate thrust imbricated with thin-bedded dark carbonate. At one locality, over 20 southeast-verging fault panels have been mapped or inferred. Most are between 5 and 100 m thick and parallel a major high-angle fault along which a segment of the Nakina River flows. Mihalynuk et al. (2002) recognized a similar structural imbrication north of lower Horsefeed Creek and attributed it to formation of the Cache Creek accretionary prism. Other parts of the carbonate belt may be similarly deformed, but poor exposure and lack of contrasting strata make recognition difficult. Greater structural and stratigraphic coherence is observed in parts of the carbonate belt that appear to constitute a sheet resting on the imbricated rocks and folded by northwest-trending folds. In the central part of NTS 104 N/2E, an apparent fold closure with Permian carbonate enveloping imbricated Middle Triassic chert was interpreted from 2001 mapping. Critical re-evaluation of this fold hinge in 2002 confirmed a sheared contact in an antiformal closure. The folded fault contact is interpreted to be part of a regional fault that soles the carbonate belt.

Chert–basalt belt

The chert–basalt belt is bound to the east by a high-angle thrust fault that juxtaposes Permian carbonate with Middle Triassic chert. New mapping suggests that the fault extends northward to near Kuthai Lake (Fig. 3) and at least as far south

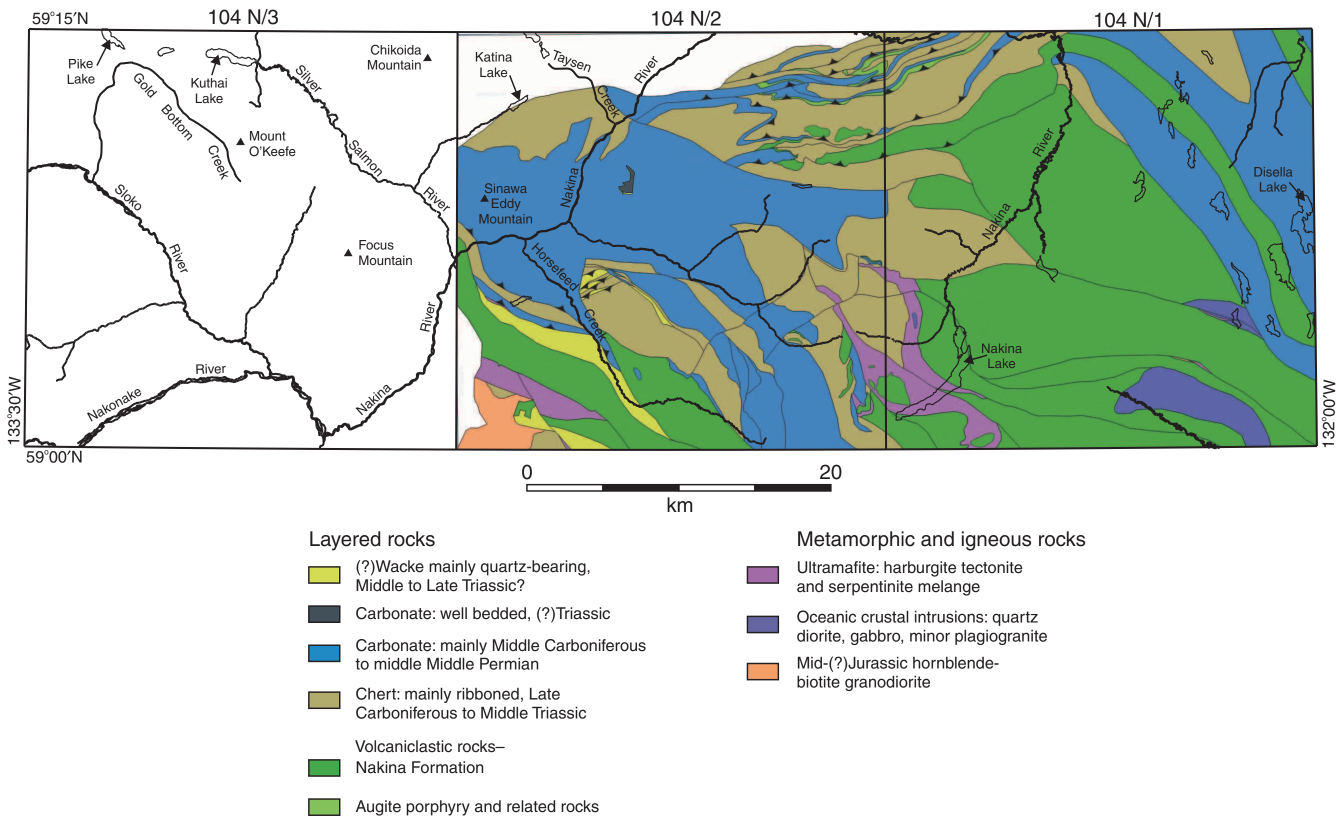

Figure 3*. Nakina transect — generalized bedrock geology in map areas NTS 104 N/1 and 2 (*after *Mihalynuk et al., 2002).*

as the bend in Horsefeed Creek. Along Horsefeed Creek, it bounds a 500 m wide southern prong of the carbonate belt. Chert–basalt exposures along this part of Horsefeed Creek are extensively affected by brittle deformation and intercalation of 10 m thick panels of chert and cherty volcanic and mafic volcanic rocks.

Ribbon chert predominates along the eastern margin of the belt, but gives way to mafic volcaniclastic and flow rocks that constitute most of the belt. Most abundant are mint-green, aphanitic mafic lapilli and ash tuff or tuffite. Primary textures are commonly well preserved. Northwest of Kuthai Lake, olistostromal blocks of carbonate rock over 100 m long are juxtaposed with maroon- and black-weathering lapilli tuff and breccia. Similar volcanic layers are mapped within well bedded carbonate rock on the western flank of Sinawa Eddy Mountain (Fig. 3), representing a possible, albeit tenuous, stratigraphic link across the fault. The southwestern boundary of the belt is mapped at the first occurrence of serpentinite.

Serpentinite mélange belt

Coincident with the eastern boundary of the mélange belt are panels of thinly bedded siltstone and an abrupt westward increase in mountain-sized and smaller exposures of mint-green volcaniclastic rocks with intervening scaly serpentinite. Swampland west of the Silver Salmon River in the central part of NTS 104 N/3E is underlain mainly by serpentinite, although resistant knockers, some up to several hundred metres across, are conspicuous as they stick up out of the swamps (Fig. 4).

Although aerially subordinate to mafic volcanic rocks, chert constitutes entire mountainsides within this belt, such as at Focus Mountain and at the headwaters of Gold Bottom Creek (Fig. 3). Serpentinite occurs along the boundaries of all major domains and becomes increasingly dominant westward. Knockers within the western belt are generally less than 1 or 2 km in maximum dimension. North of the Nakina River, the dominant knocker material is structurally disaggregated harzburgite. Gabbro and hornblende diorite are subordinate to harzburgite along the western margin of the belt and increase in abundance eastward. South of Mount O’Keefe, at the headwaters of Gold Bottom Creek, a folded, subhorizontal, sheet-like body of gabbro displays an intrusive contact with overlying mafic volcanic rocks and a fault contact with underlying ultramafic, mafic, and quartz-rich clastic rocks. It is interpreted as an allochthonous sheet of gabbro–basalt. Folded thrust faults in the footwall of the allochthon have southwest vergence.

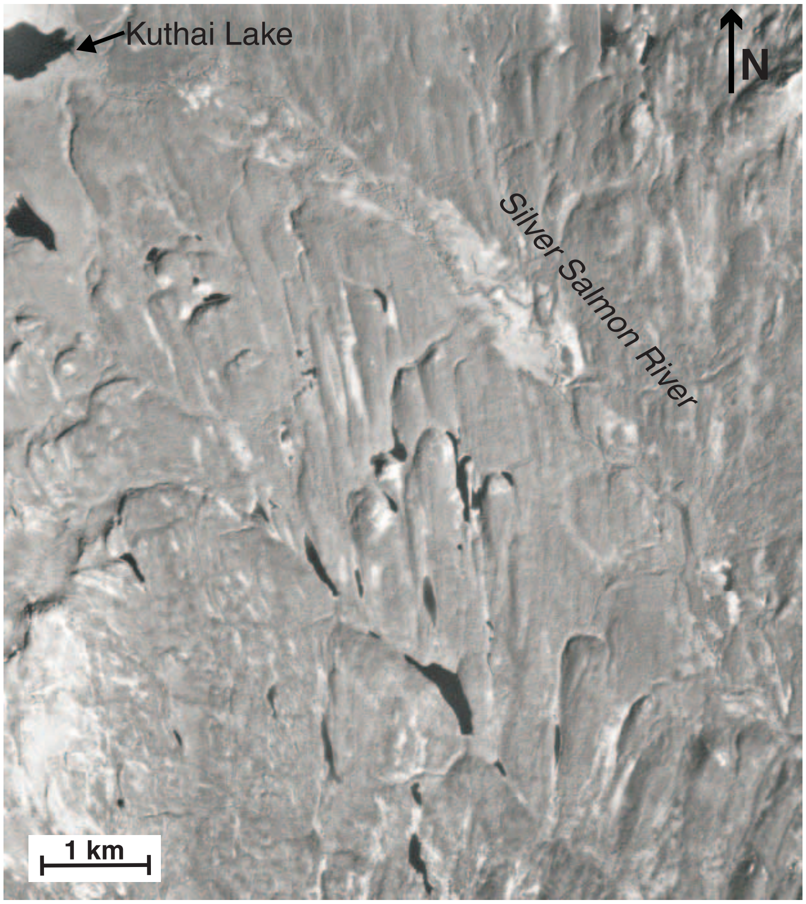

Figure 4.

Airphoto showing mega-rat-tails formed by scouring of recessive serpentine from the leading sides of resistant knockers, and preservation on the lee sides, as ice moved southward during the last glaciation. BC 87080 #189

Nahlin Fault

Good exposures of serpentinite mélange and Laberge Group wacke can be mapped to within several metres of the trace of the Nahlin Fault (Fig. 2). Geometric constraints provided by the outcrop distribution necessitate a nearly vertical orientation for this fault. East of Pike Lake, outcrops of fresh basalt included with the Sloko Group are truncated abruptly at the fault. Motion along the Nahlin Fault is therefore at least as young as the Sloko Group, dated at 55 Ma in this region (*see* Mihalynuk, 1999).

Laberge Group

Laberge Group strata are restricted to west of the Nahlin Fault. In order of relative abundance, they comprise feldspathic sandstone, wacke, siltstone, granule conglomerate, argillite, boulder conglomerate, and rare limestone. Paleontological age control is absent, although fossil spores are present and may provide age control. Several distinctive map units can be recognized in the great thickness of Laberge strata, including garnetiferous wacke, andesitic granule-bearing wacke, orange-weathering calcareous wacke, magnetic wacke, and white-striped argillite–siltstone. The most peculiar unit is the garnetiferous wacke; it contains up to 5% subangular to subrounded orange garnets, accessory titanite, and rare pristine olivine grains along with more common wacke constituents including subidiomorphic green hornblende and plagioclase and sparse pyroxene. The common volcanic constituents and probable mantle source of olivine and orange garnet suggest a dual provenance. The preliminary hydrocarbon assessment of the Laberge Group within and southwest of the Nakina transect shows that it is mature and gas-prone (English et al., in press).

AGE AND PALEOENVIRONMENT OF THE CACHE CREEK COMPLEX

Three groups of paleontologists participated in the Atlin project in 2002. F. Cordey (Université Claude Bernard, France) completed processing and analysis of 89 radiolarian-bearing samples collected during 2001. Sixty-seven of these, taken from ribbon chert and argillite in the Kedhada Formation (as defined by Monger, 1975; *see* Monger (1975) and Mihalynuk et al. (2002) for a discussion of the problematic use of 'formation' nomenclature within the complex), yielded diagnostic assemblages ranging in age from Early Permian to Late Triassic (*Pseudoalbaillella lomentaria* to *Capnodoce* zones; Mihalynuk et al., 2002). Sixty additional radiolarian-bearing samples were collected in map areas 104 N/2 and N/3 in 2002. As was the case in 2001, a radiolarian extraction facility was established at the Atlin base camp for preliminary field processing and analysis. Ten of the field-processed samples yielded seven diagnostic assemblages ranging in age from

Middle Permian (Capitanian–Wordian) to Late Triassic (late Carnian–middle Norian). Processing of the remaining 50 samples is now underway at Université Claude Bernard. Early results indicate that most productive radiolarian sample localities are Middle Triassic (70% of samples), with some Early Permian (17%) and Late Triassic (8%). Only one Middle Permian locality has been identified. Interestingly, no radiolaria of confirmed Carboniferous age have been identified, nor any of Late Permian, Early Triassic, or Early Jurassic ages (although radiolaria with age ranges spanning these periods have been recovered).

H. Sano and assistants (Kyushu University, Japan) concentrated their efforts along the southern margin of Sentinel Mountain (Fig. 2), where the Kedhada and Horsefeed formations (Monger, 1975) are well exposed and readily accessed. Their mapping (Sano et al., in press) shows that the base of the Kedhada Formation consists of basaltic lava flows overlain by massive chert that includes slump blocks of shallow-marine carbonate rock. The chert is overlain by argillite and greywacke. Radiolaria extracted from the chert yield middle to upper Lower Permian ages. The Horsefeed Formation consists of massive, locally bedded, shallow-marine, siliceous and carbonaceous limestone containing upper Lower Permian fusilinids. These new observations confirm the paleographic interpretation of Monger (1975) who suggested that the Kedhada and Horsefeed formations formed on and around a basalt seamount or oceanic plateau. The two formations are interpreted as time-stratigraphic equivalents linked by shallow-marine carbonate rock of the same age found in the siliceous rocks of the Kedhada Formation.

During 2002, M. Orchard (GSC) processed 36 conodont collections acquired in the Nakina transect in 2001, 14 of which were from a unit that may correlate with ammonoid- and fusilinid-bearing strata along strike. Four additional samples were separated from the matrix of ammonoid specimens submitted to paleontologists at GSC Calgary. None of the samples from the ammonoid-bearing beds contained conodonts, presumably reflecting an inhospitable environment favoured by fusulinaceans and containing transported ammonoid shells. Nine of the remaining samples produced conodont collections. None were large, and preservation ranged from very poor (Paleozoic) to poor (Triassic). Conodont colour alteration index (CAI) values, reflecting the degree of heating (due to intrusions or burial), ranged from 5 for Triassic conodonts to generally greater than 5 for Paleozoic collections.

The oldest collection recovered was of probable Bashkirian to Moscovian (Late Carboniferous) age and consisted of *Idiognathoides* sp. and *Neognathodus* sp.? These elements are well known within the Cache Creek Complex in the Fort Fraser region of central British Columbia (Orchard et al., 2001) where they characterize the first major carbonate buildup known in that region (although in Atlin they begin earlier). Permian conodont collections are tentatively identified from three samples, but diversity and preservation are extremely poor. Questionable species of *Sweetognathus*? and *Hindeodus*? occur with indeterminate ellisonids; a more precise age cannot be provided at present. The two youngest conodont collections are Anisian (Middle Triassic), from *Neogondolella szaboi*, and late Ladinian–early Carnian (Middle–Late Triassic), from questionable elements of *N. inclinata* together with *Metapolygnathus polygnathiformis*. Three other collections contain only undiagnostic ramiform elements with CAI = 5, which implies but does not prove a Triassic age. Additional processing of these samples is underway and may produce more diagnostic collections.

M. Villeneuve (GSC) collected two samples from the Cache Creek complex for radioisotopic geochronological analysis. One is from a coarse- to fine-grained hornblende gabbro–diorite to quartz diorite intruding volcanic and volcaniclastic rock of the Nakina Formation. The other is a sample of leuco-plagiogranite segregations with coarse plagioclase up to 2 cm and hornblende (in parts) up to 7 to 8 mm. This latter sample is from within the finer crystalline gabbroic unit, interpreted to underlie oceanic basalt as part of an upper ophiolite-type sequence (Mihalynuk et al., 2002). Both samples yielded correlative Permian U-Pb zircon ages and the second sample also gave an similar Ar-Ar age from hornblende.

MESOZOIC PLUTONIC ROCKS

In order to define the nature of regional plutonic suites and facilitate an evaluation of their potential for granophile and auriferous metallic mineral deposits, R.G. Anderson (GSC) and assistants mapped and sampled the Llangorse Mountain and Mount McMaster plutons and the Surprise Lake batholith (Fig. 2). M. Villeneuve undertook U-Pb zircon isotopic geochronological analyses of the plutonic samples. His results confirm correlative Middle Jurassic ages for the Llangorse Mountain and Mount McMaster plutons, as well as a Late Cretaceous age for the Surprise Lake batholith. Further Ar-Ar and U-Pb dating of plutonic suites is underway.

Llangorse Mountain pluton

The Llangorse Mountain pluton is the most extensive pluton in the southern project area (Fig. 2). Its aeromagnetic response is complex, but helps divide it into eastern (weakly magnetic) and western (moderately magnetic) parts. Hornblende-biotite-quartz monzodiorite, which underlies the lowest magnetic values in the eastern part of the pluton, is distinctively mafic, rich in biotite compared with compositions to the west, and characterized by magnetic susceptibilities that are commonly $<1 \times 10^{-3}$ SI. This undeformed phase is also mapped within 100 m of a 200 to 500 m wide zone of deformed metasedimentary rocks along the northwestern margin of the pluton. The western part of pluton is more siliceous, leucocratic, and homogeneous than the eastern part. An obvious and close correlation exists between changes in magnetic susceptibility (range 0.4×10^{-3} to 14×10^{-3} SI) and magnetic anomaly values, but not with megascopic composition. The dominant rock type is a foliated to unfoliated, medium- to coarse-grained, biotite-hornblende-quartz monzonite to monzogranite with titanite as a rare but distinctive accessory mineral. The prismatic and slightly coarser grain size of the hornblende, compared with other minerals, is also distinctive. Aplite and pegmatite segregations are rare and scattered. Subparallel, east-trending arrays of re-activated subvertical joints in the central part of the western region are barren of mineralization, but characterized by centimetre-scale zones of alkali feldspar alteration or silicification. Extensive and small successions and intrusions of Tertiary or younger olivine alkali basalt are rare, but occur within the batholith.

Mount McMaster pluton

Compared with the Llangorse Mountain pluton, the Mount McMaster pluton is finer grained, unfoliated, and more felsic and leucocratic. It is subcircular in plan (Fig. 2) and composite, consisting of irregularly distributed felsic and intermediate phases. The felsic phase, biotite monzogranite to quartz monzonite, which occurs mainly in the northeastern part of the pluton, is fine to medium grained, equigranular to aplitic, leucocratic, and unfoliated. Brittle fractures and apparently barren quartz veins are scattered and uncommon; alkali feldspar- and quartz-filled miarolitic cavities occur along one intrusive contact with a pendant of metasedimentary schist. Hornblende-biotite granodiorite and quartz monzodiorite are most common south of the Mount McMaster summit, but no apparent correlation exists between the megascopic composition within this intermediate phase and magnetic anomaly patterns. The phase is texturally and structurally similar to the felsic monzogranite phase, but is more melanocratic, hornblende-rich, and contains biotite; poikilitic alkali feldspar plates are common and titanite is a distinctive accessory mineral.

Surprise Lake batholith

The Surprise Lake batholith (Fig. 2) is the largest and best studied of the three intrusions. Previous work focused on its southwestern lobe and on the numerous and varied base-metal, uranium, and granophile metallic mineral occurrences. Except for some narrow, northwesterly trending magnetic lineaments (Lowe and Anderson, 2002), the batholith is characterized by very low-amplitude anomalies and magnetic susceptibility values <0.1 x 10^{-3} SI. Reconnaissance mapping indicates that the biotite granite batholith is compositionally homogeneous, but texturally heterogeneous, consisting of irregularly distributed, medium- to coarse-grained, equigranular, seriate, megacrystic, biotite-alkali feldspar-quartz porphyry and finer-grained aplite phases. In areas of continuous exposure and maximum structural relief, a gradational change with structural height includes (from base to top) seriate to megacrystic biotite granite (with common simple pegmatite or filled miarolitic cavities), alkali-feldspar porphyry, and equigranular biotite granite with abundant irregular quartz veins. Megacrystic or porphyry textural phases are most commonly associated with granophile or uranium mineral occurrences; extensive, scattered zones of centimetre- to decimetre-sized miarolitic cavities filled with alkali feldspar, quartz, and tourmaline or simple pegmatite characterize the batholith and are the best record of its epizonal character, including the evolution of vapour and fluid phases during late-stage evolution of the pluton.

LLANGORSE VOLCANIC FIELD

The Llangorse volcanic field is an informal term for exposures of Neogene volcanic rocks that are distributed over 144 km² near Llangorse Mountain (Fig. 2). The exposures are dominated by erosional remnants of lava flows, dykes, and minor pyroclastic deposits. K. Russell and M. Harder (University of British Columbia) undertook an investigation of the Llangorse volcanic field, focusing on three localities first delineated by Aitken (1959). Later they expanded their study to include a previously unmapped lava flow and two small (<5 m²), isolated volcanic exposures. Preliminary petrographic analysis indicates that the Llangorse volcanic field is characterized by two texturally and mineralogically distinct lava types: fine-grained lava characterized by pyroxene xenocrysts and fine- to medium-grained lava without pyroxene xenocrysts. Where present, the pyroxene xenocrysts are 0.5 to 1.5 cm long, subhedral, vitreous, black, and commonly feature well developed, 1 to 2 mm wide reaction rims. Crustal xenoliths are rare and dominated by granodiorite and chert, similar to those exposed in the nearby Llangorse Mountain pluton and Cache Creek Complex, respectively. In contrast, peridotitic mantle xenoliths dominated by spinel lherzolite are abundant and observed in most flow units. Xenoliths typically range from 3 to10 cm in diameter with the largest being 25 to 40 cm in diameter. At two localities, peridotitic xenoliths occur as clasts in volcaniclastic units.

Abundant evidence exists for a close spatial and temporal association between volcanism and substantial masses of ice, including the following: 1) fine-scale, horizontal-, radial-, and chaotic-oriented jointing consistent with the quenching of lava against ice; 2) overthickened lava flows in paleovalleys consistent with ponding of lava against valley-filling ice masses; and 3) the presence of volcaniclastic debris-flow deposits and possible hyaloclastite deposits immediately underlying lava flows indicative of the presence and release of substantial volumes of water during the eruptive process. See Harder et al. (2003) for more details.

MAGNETIC INVESTIGATIONS

C. Lowe and D. Canil (University of Victoria) conducted a traverse across the Nahlin ultramafic body and adjacent Cache Creek complex (Fig. 2) in 2002. At the localities visited, the ultramafic rocks were dominated by harzburgite, although pods of dunite, some over 30 cm thick, were common. In situ magnetic susceptibility values for dunite ranged from 4.5 x 10^{-3} SI to 9.8 x 10^{-3} SI (mean = 5.2 x 10^{-3} SI) and for harzburgite, from 0.43 x 10^{-3} SI to 14.6 x 10^{-3} SI (mean = 6.49 10^{-3} SI). These values are lower than those measured in similar rock types elsewhere in the project area (mean dunite and harzburgite values of 13.9 x 10^{-3} SI and 23.9 x 10^{-3} SI, respectively; Lowe and Anderson, 2002). Serpentinization was observed along fractures and veins; however, thin sections of Nahlin harzburgite show that it is relatively unserpentinized (<10%) compared with harzburgite massifs exposed around the Atlin townsite. Magnetic susceptibility generally increases with increasing serpentinization: some intensely serpentinized samples in the Nahlin ultramafic body yield values >200 x10^{-3} SI. Interestingly, the most intense magnetic anomaly values (>2000 nT) occur in areas where surface rocks are only moderately serpentinized, suggesting that the ultramafic rocks are more pervasively and intensely serpentinized at depth than at the surface, or that ultramafic rocks persist to very great depths (>7 km). Detailed modelling of the airborne data incorporating the new in situ susceptibility measurements is underway to evaluate these two hypotheses.

In a related study, the relationship between magnetic susceptibility and degree of serpentinization of ultramafic rocks is being investigated. As a first step, magnetic susceptibility was measured in 29 ultramafic rocks for which loss on ignition (LOI) was available from bulk-rock analyses. The 29 samples spanned seven geographically distinct regions in the Cordillera, including five samples from the project area. Loss on ignition is the reduction, in weight per cent, of a sample upon heating to 1000EC during the geochemical assay process. In the case of serpentinized ultramafic rocks, LOI may be proportional to the amount of hydrous phases (serpentine and chlorite, brucite) present in the sample and therefore an indirect measure of the degree of serpentinization. However, measured magnetic susceptibility values show a very poor linear correlation with LOI and further investigations are underway to determine whether the degree of serpentinization of ultramafic rocks can be reliably estimated from magnetic measurements.

SURFICIAL GEOLOGY AND PLACER POTENTIAL

Levson et al. (in press) produced a surficial geology and placer potential map of the Atlin mining district. The map is an updated colour version of an earlier publication by Levson and Kerr (1992) and includes results from new work conducted under the Atlin TGI project. New data include a digital elevation model of the region (available at http://www.pgc.nrcan.gc.ca/atlintgi/dem.htm, accessed December 2002), recently published research on the Quaternary geology of the area (Levson and Blyth, 2001), and new field observations and geochemical data on platinum in placer deposits (Levson et al., 2002). Notes accompanying the map provide detailed discussions on placer-gold potential (both buried-channel and Holocene placer deposits) throughout the Atlin mining district and on bedrock having potential to yield gold to the placer environment.

NEW MINERAL DISCOVERY

High-grade copper mineralization was discovered by the Nakina bedrock mapping team within oceanic crustal rocks of the Cache Creek complex (Fig. 2; Mihalynuk et al., in press). The discovery has been named Joss'alun. Semimassive sulphide mineralization is exposed at or below treeline in low, rubble-strewn outcrops within and south of a shallowly incised valley (Fig. 5). The outcrops are gossanous with weak copper staining. Mineralization consists of a series of stacked, apparently conformable lenses of chalcopyrite, lesser pyrite, and quartz-chlorite gangue. Chip and grab-sample assays yield copper values ranging from 3.35 to 10.15%. Individual lenses are commonly brecciated, exceed 3 m in strike length, are up to 90 cm thick, and are structurally stacked over an interval that is over 10 m thick. Chalcopyrite occurs as discordant veins up to 5 cm wide, together with

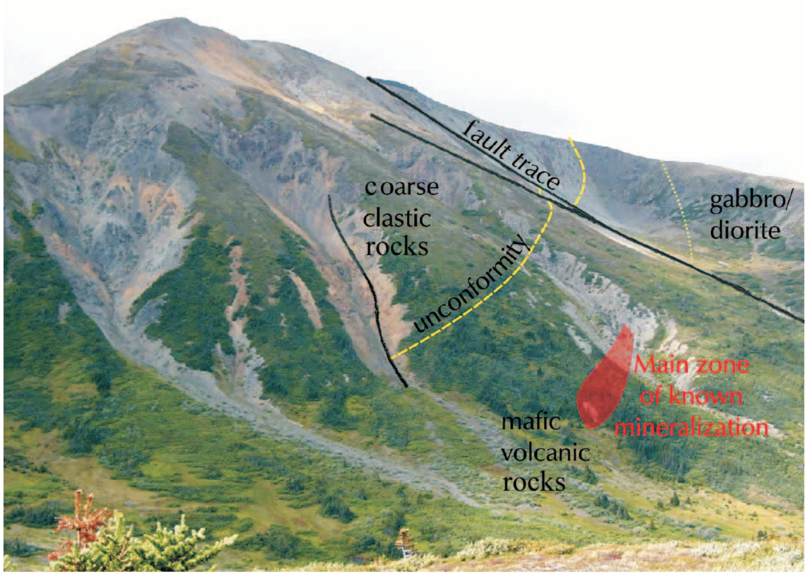

Figure 5.

Geological setting of the Joss'alun discovery. Photograph courtesy M.G. Mihalynuk, 2002.

some float of semimassive sulphide. Mineralized outcrops occur over a distance of 255 m and chalcopyrite has been observed in mafic volcanic rocks up to 1 km away, along the trend of the host rocks in the discovery zone.

Host rocks are dominantly mafic submarine volcaniclastic rocks (Nakina Formation; Fig. 5) Given that these rocks are one of the most common rock types in the project area (Aitken, 1959; Mihalynuk et al., 1996, 2002; English et al., 2002), Joss'alun raises the possibility of further massive-sulphide discoveries within the Cache Creek complex. Public announcement of the discovery led to staking of claims by three companies.

Since the inception of the Atlin TGI project in March 2000, 784 units (19 600 hectares) have been staked in the project area.

DATA DISSEMINATION AND OUTREACH INITIATIVES

Timely delivery and dissemination of geoscience data and information to client and stakeholder groups continue to be key objectives of the Atlin TGI project team. In 2002, these objectives were accomplished through a variety of mechanisms. For example, a timed information release announcing the Joss'alun discovery was delivered at the Mineral Development Office, Vancouver, on 13 September 2002; at the same time, a digital version of the information release was posted on the provincial government's website and circulated via email to a distribution list of interested parties. Upgrades to the project website (www.pgc.nrcan.gc.ca/atlintgi/, accessed December 2002) were implemented as new results became available. Five published manuscripts (English et al., 2002; Lowe and Anderson, 2002; Lowe and Mihalynuk, 2002; Mihalynuk and Lowe, 2002; Mihalynuk et al., 2002) and nine conference presentations providing comprehensive overviews of project activities and summaries of initial results were delivered. A one-day workshop on magnetic surveying for mineral prospectors and the general public was delivered in Atlin on 20 July 2002. Development continued of a Geoscape Atlin poster focusing on the geology and history of gold in the project area; the poster, which is scheduled to be completed in 2003, will be promoted as a tool for local Earth science education.

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