Geological Survey of Canada

CURRENT RESEARCH
2006-A4

Geological assessment of known Zn-Pb showings, Mackenzie Mountains, Northwest Territories

K. Dewing, R.J. Sharp, L. Ootes, E.C. Turner, and S. Gleeson

2006

Natural Resources Canada Ressources naturelles Canada

Canada

CURRENT RESEARCH

ISSN 1701-4387
Catalogue No. M44-2006/A4E-PDF
ISBN 0-662-43134-0

A copy of this publication is also available for reference by depository libraries across Canada through access to the Depository Services Program's Web site at http://dsp-psd.pwgsc.gc.ca

A free digital download of this publication is available from GeoPub: http://geopub.nrcan.gc.ca/index_e.php

Toll-free (Canada and U.S.A.): 1-888-252-4301

Critical Reviewer
Peter Hannigan

Authors' addresses

K. Dewing (kdewing@nrcan.gc.ca)
Geological Survey of Canada
3303-33rd Street NW
Calgary, AB T2L 2A7

R.J. Sharp (rjsharp@shaw.ca)
Trans Polar Geological
60 Hawkmount Heights NW
Calgary, AB T3G 3S5

L. Ootes (luke_ootes@gov.nt.ca)
Northwest Territories
Geoscience Office
Box 1500, 4601b - 52nd Avenue
Yellowknife, NT X1A 2R3

E.C. Turner (eturner@laurentian.ca)
Laurentian University
Department of Earth Sciences
Sudbury, ON P3E 2C6

S. Gleeson (sgleeson@ualberta.ca)
University of Alberta
Department of Earth
and Atmospheric Sciences
Edmonton, AB T6G 2E3

Publication approved by GSC Calgary

Original manuscript submitted: 2006-02-28
Final version approved for publication: 2006-03-21

Correction date:

Geological assessment of known Zn-Pb showings, Mackenzie Mountains, Northwest Territories

K. Dewing, R.J. Sharp, L. Ootes, E.C. Turner, and S. Gleeson

Dewing, K., Sharp, R.J., Ootes, L., Turner, E.C., and Gleeson, S., 2006: Geological assessment of known Zn-Pb showings, Mackenzie Mountains, Northwest Territories, Geological Survey of Canada, Current Research 2006-A4, 12 p.

Abstract: The Mackenzie Mountains have more than 100 Zn-Pb showings. The objectives of the 2005 fieldwork were 1) to assess showings from a wide geographic area and stratigraphic range, 2) verify the assessment files, and 3) rank the showings on exploration potential.

TIC, ART-EKWI, BEAR, ICE, KEG, RAIN, TAP, AB, and GAYNA were visited. Most of the showings are hosted in fractures with minor brecciation and very rarely, carbonate replacement. The main economic minerals are sphalerite and galena, but copper sulphide minerals are commonly present. Gangue minerals include dolomite, calcite, quartz, barite, and fluorite. The best targets for further exploration are considered to be showings hosted in strata that were limestone (at the time of mineralization) rather than dolostone; that exhibit strong chemical interaction between the host rock and fluid resulting in carbonate dissolution or replacement; and that have multiple generations of sphalerite and galena. BEAR, GAYNA, AB, and TIC are considered the most attractive exploration targets.

Résumé : Les monts Mackenzie comptent plus de 100 indices de zinc-plomb. Les travaux exécutés sur le terrain en 2005 avaient pour objets (1) l'évaluation des indices sur une vaste étendue géographique et stratigraphique, (2) la vérification de dossiers d'évaluation et (3) le classement des indices par ordre d'intérêt pour l'exploration.

Les indices TIC, ART-EKWI, BEAR, ICE, KEG, RAIN, TAP, AB et GAYNA ont été examinés. La plupart d'entre eux sont dans des fractures qui présentent une légère bréchification et, très rarement, un remplacement des carbonates. Les principaux minéraux à valeur commerciale sont la sphalérite et la galène, mais on trouve aussi souvent des sulfures de cuivre. Les minéraux de gangue sont, entre autres, la dolomite, la calcite, le quartz, la barytine et la fluorine. Les cibles d'exploration les plus intéressantes seraient les indices qui sont encaissés dans des strates qui se composaient de calcaire plutôt que de dolomie au moment de la minéralisation; dans lesquels une forte interaction chimique entre la roche encaissante et les fluides a donné lieu à la dissolution ou au remplacement des carbonates; et qui comportent de nombreuses générations de sphalérite et de galène. Les indices BEAR, GAYNA, AB et TIC sont considérés comme les cibles d'exploration les plus intéressantes.

GEOLOGICAL SETTING

The Zn-Pb district of the Mackenzie Mountains, Northwest Territories, occurs roughly between the Keele and the Arctic Red rivers, or 63° and 65°N between 128° and 132°W in map areas 105 P, 106 A, B, and C (Figure 1).

There are five main stratigraphic packages exposed in the Mackenzie Mountains (Fig. 1 and 2; Fritz et al., 1991). 1) The Mesoproterozoic Mackenzie Mountain Supergroup consists of four units (H1, Tsezotene Formation, Katherine Group, and Little Dal Group). These formed in an intracratonic basin culminating in the carbonate-reefal-evaporitic Little Dal Group. 2) The Neoproterozoic Windermere Supergroup (Coates Lake Group, Rapitan Group, Twitya, Keele, Sheepbed, Gametrail, Blueflower and Risky formations). These record rifting to passive margin settings. 3) The latest Precambrian to Cambrian succession consists of the Ingta, Backbone Ranges, Vampire, and Sekwi formations. These were deposited in shelf, ramp, and deep-water settings along a passive margin. 4) The Upper Cambrian to Lower Silurian succession consists of the units that form the Mackenzie Platform: the Franklin Mountain, Sunblood, Whittaker, and Mount Kindle formations; and the deep-water Road River Formation. 5) The Devonian succession includes shallow-water carbonate and evaporite units of the Camsell, Delorme, Sombre, Arnica, Landry, and Nahanni-Headless formations. These units are overlain by the Horn River and Besa River shales of Late Devonian age.

The deep-water equivalents of the Mackenzie Platform occur in the Selwyn Basin in the western part of the study area. This region of deep-water sedimentation persisted from late Precambrian to Middle Devonian time. It contains the Rabbitkettle and Road River formations that are the deep-water equivalents to the Ordovician and Devonian platformal strata. These are overlain by rift clastic rocks of Late Devonian age.

During the Late Cretaceous-Tertiary Laramide Orogeny, these units were thrust and folded into their current configuration. There are broad anticlines and synclines that reflect the overall thrusting pattern, but at a local scale, units are often tightly folded.

Carbonate- and shale-hosted mineralization is widespread throughout the Mackenzie Platform and Selwyn Basin. More than 300 mineral showings are listed in the Northwest Territories NORMIN and the Yukon MINFILE databases. These include the past producers around Faro, Yukon, as well as the deposits at Howard's Pass, Tom, Jerry, and Gayna River. At least three mineralizing events are known: Middle Cambrian (Faro); Early Silurian (Howard's Pass); and Late Devonian (Tom, Jason), as well as a likelihood of mineralization related to Cretaceous intrusions (Mactung).

The Mackenzie Mountain Zn-Pb belt was actively explored in the 1970s with more than 100 showings discovered (Fig. 1), but exploration ceased in the late 1970s owing to low commodity prices and the remoteness of the area (Fig. 3). Interest in the Mackenzie Mountain Zn-Pb belt is undergoing a revival as a result of higher commodity prices and the prospect of an improvement in infrastructure related to hydrocarbon exploration.

2005 FIELDWORK

The objectives of the 2005 fieldwork were 1) to visit and sample showings from a wide geographic area and stratigraphic range; 2) to compare the observed mineralization and alteration to that reported in the assessment files available from the NORMIN database (www.nwtgeoscience.ca/normin); 3) to rank the showings using exploration criteria such as stratigraphy, structure, carbonate alteration/dissolution textures, and ore textures; and 4) to sample for geochronological and geochemical studies which will help determine the number and timing of fluid events.

The showings at TIC, ART-EKWI, BEAR, ICE, KEG, RAIN, TAP, AB, and GAYNA were visited and assessed (Fig. 1, Table 1). The extensive GAYNA showings will be addressed in a separate publication. The locations described in NORMIN were found to be accurate, but the showing descriptions in the assessment files varied greatly in quality and completeness. Most of the showings visited are hosted in fractures with minor brecciation and rarely, carbonate replacement. The main economic minerals are sphalerite and galena, but copper sulphide minerals are commonly present. Gangue minerals include dolomite, calcite, quartz, barite, and fluorite. The showings appear to be structurally controlled, with a secondary stratigraphic control.

Many of these showings are listed in NORMIN, and in the assessment files, as Mississippi Valley-–type (MVT) Zn-Pb showings, but the presence of common quartz, barite, and copper sulphide minerals, along with fluid inclusions formed between 165 and 200°C (Carrière and Sangster, 1999) make it unlikely that these are MVT deposits. The mineralogy, textures, limited fluid-inclusion homogenization temperatures, and inclusion chemistry indicate that an Irish-style, polymetallic vein, SEDEX, or intrusion-related deposit model is more appropriate. Mineralizing events in the area are known to be from the Cambrian (Faro), Silurian (Howard's Pass), Devonian-Mississippian (Tom, Jason), and there are numerous Cretaceous intrusions in the area. Ongoing geochronological and geochemical studies will help to classify these showings.

A Devono-Mississipian age is indicated for Gayna River showings, based on eight lead isotopic analyses that match the 'Young Carbonate Model'of Godwin et al. (1981). Additional samples from the 2005 fieldwork are currently being analyzed.

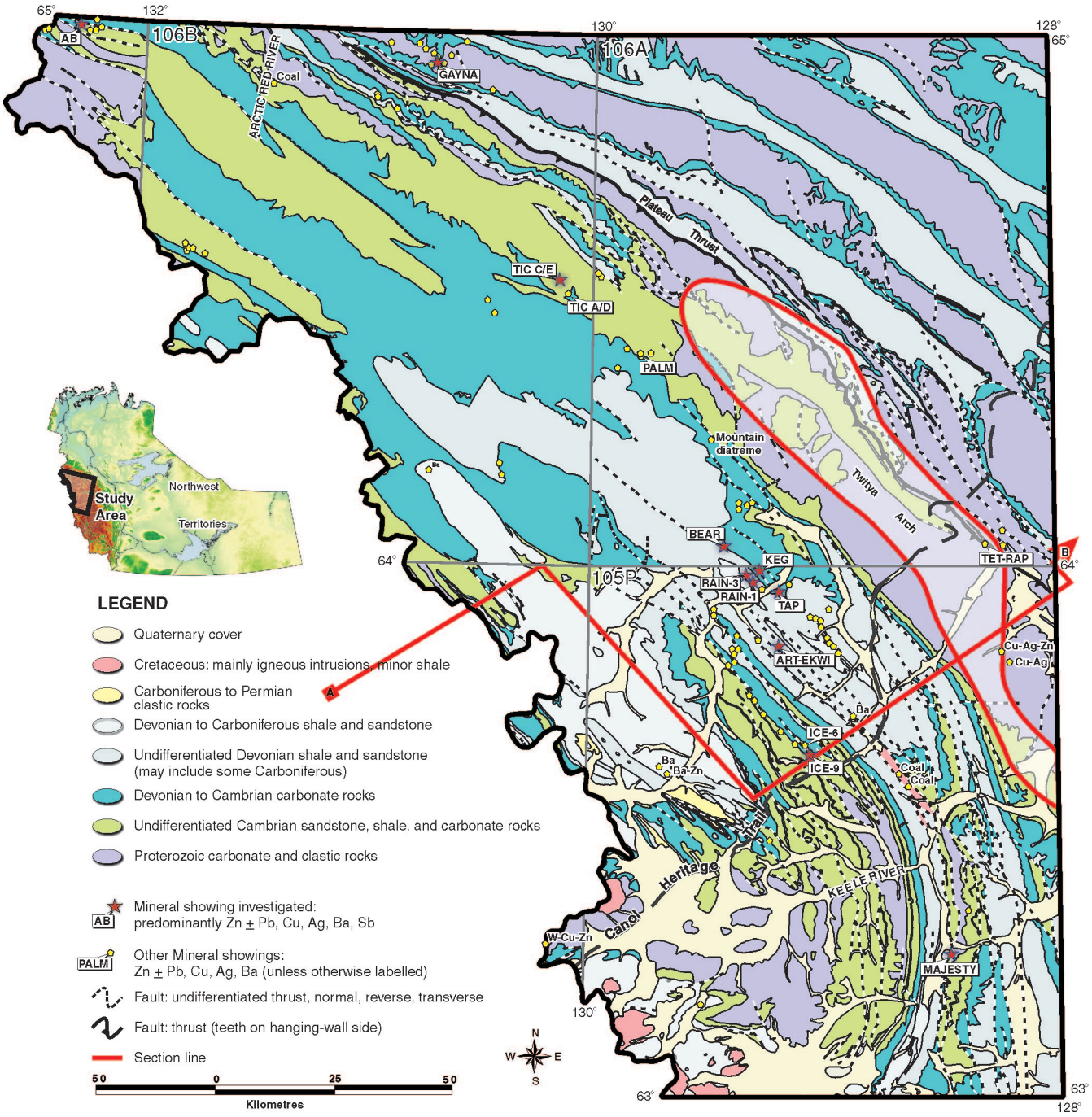

Figure 1. Location and geological maps of the Mackenzie Mountains. Red line shows the location of cross-section in Figure 7. Twitya Arch and Plateau Fault after Cook and Aitken (1978). Geology simplified from Aitken and Cook (1974), Blusson (1972, 1974), Gordey and Makepeace (2003). Mineral showings from: NORMIN.DB (www.nwtgeoscience.ca/normin)

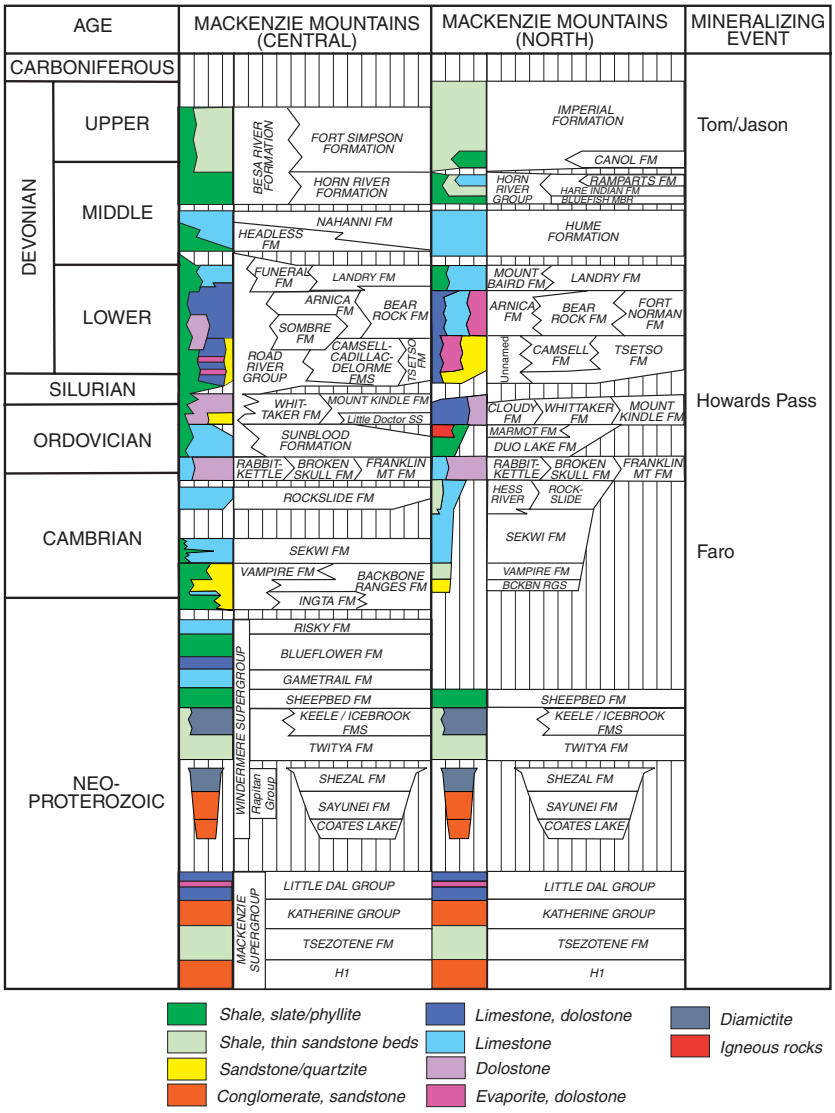

Figure 2. Simplified stratigraphy of the Mackenzie Platform (after Aitken, 1993; Aitken and McMechan, 1991; Fritz et al., 1991; MacNaughton et al., 2000, Narbonne and Aitken, 1995).

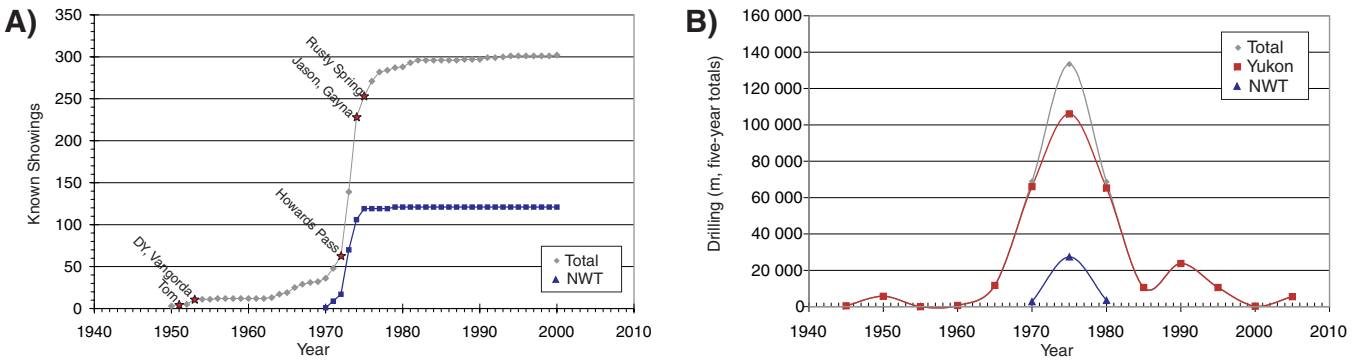

Figure 3. The Discovery Process. Exploration started in the early 1950s resulting in discovery of the Tom, DY, and Vangorda deposits. The number of discovered showings increased dramatically in 1972–1974 and resulted in the discovery of the deposits at Jason, Howards Pass, Gayna River, and Rusty Spring. **A)** Number of discovered showings vs. year for the Selwyn-Mackenzie Platform Zn-Pb district of the Yukon-Nortwest Territories. **B)** Metres drilled in five-year intervals within the Selwyn-Mackenzie Platform district.

Table 1. Locations of showings.

Showing Name	Normin ID	Latitude	Longitude	NTS
TIC (C-D Zones)	106BNE0028	64.5372	-130.1492	106 B/09
ART-EKWI No.1, 2, 3, 4	105PNW0018	63.855	-129.1828	105 P/14
BEAR	106ASW0002	64.0389	-129.4225	106 A/03
ICE 9	105PNW0020	63.6492	-129.0522	105 P/11
KEG	105PNW0001	63.995	-129.2656	105 P/14
RAIN Zone 3	105PNW0012	63.9878	-129.3247	105 P/14
TAP No. 1	105PNW0002	63.9547	-129.1814	105 P/14
AB Showing	106CNE0001	64.9897	-132.3286	106 C/16

SHOWING DESCRIPTIONS

TIC (C Zone)

Sekwi Formation dolomite hosts pyrite, sphalerite, and galena at the TIC showing. The Sekwi Formation is 300 m thick on the property and is divided into Unit 1— an orange-weathering dolomite and sandy dolomite; Unit 2 — a dark grey, medium- to coarsely-crystalline, medium-bedded dolostone with beds of oolites, and oncolites. Unit 3 hosts the mineralization and consists of light grey, fine to coarsely crystalline dolostone with abundant vugs and solution-collapse breccia that are cemented with sparry dolomite, quartz, and sulphide minerals. Breccia units occur over a 60 m interval, and are locally continuous over 20 m. They consist of randomly sized and oriented fragments of light grey dolomite in a matrix of internal sediment or secondary dolomite and pyrite. This matrix may comprise up to 25% of the rock and host Pb-Zn mineralization. The upper 15 to 45 m of the Sekwi Formation is composed of vuggy recrystallized dolomite.

The C Showing is approximately 300 m long and 50 m thick, although Zn-Pb mineralization is constrained to a 15 m thick band within this area. The sulphide minerals are pyrite>sphalerite>galena, but the most intensely pyritized zones are relatively low in galena and sphalerite. Mineralization occurs in coarse vugs, in randomly oriented veins, and stringers that are interpreted to be cement in solution breccias (Fig. 4).

Three diamond-drill holes with depths totaling 600 m were drilled on the C Zone in 1974 (Ronning, 1975). These intersected brecciated zones up to 20 m thick, cemented with pyrite and minor Zn-Pb mineralization.

2005 Field Assessment

1. The alteration area is large enough to host a significant deposit. Bedding-parallel pyrite and sphalerite mineralization continues along strike over 4 km and along dip over 1 km.
2. The geology of the property is simple and well mapped.
3. The mineralized beds and the underlying units are altered to sucrosic dolostone.

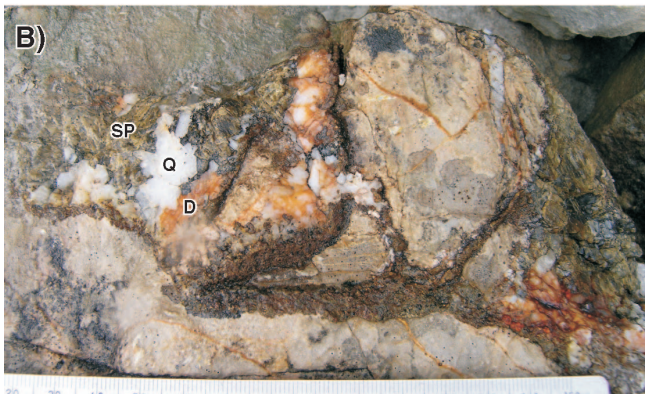

Figure 4. TIC-C. **A)** View from the base of the valley towards the mineralization at TIC-C (white outline). **B)** Mineralization at TIC-C. Scale in mm. SP - sphalerite; D - dolomite; Q - quartz. Sparry dolomite and sphalerite co-occur. Quartz postdates sphalerite.

4. Solution-collapse breccia units and dissolution features occur at the C Zone and were reported over a 20 m interval in drill core.
5. Zinc grades exposed on surface are low and do not exceed 10% Zn in any showing.
6. The pyrite and sphalerite decrease gradually upsection over about 20 m.
7. The topography is amenable to surface exploration and drilling.
8. The downdip potential is limited by both topography and a facies change.

AB

The AB showing occurs in the Lower Cambrian Sekwi Formation. The lowest exposed beds are light–grey-weathering dolomitic limestone and dolomite that are locally pyritic and rusty weathering. This is gradationally overlain by a 3 to 4.5 m thick mineralized unit, consisting of light grey dolostone that is medium bedded to nodular and finely crystalline. The mineralized unit is overlain by a soft, dark–grey- to buff-weathering, medium crystalline dolostone with oncolites and oolites, along with small rusty weathering patches and iron sulphide minerals in veins and filling pseudobreccia.

The AB showing consists of sphalerite with pyrite and minor galena and barite in fractures, breccia units, and disseminated within and replacing the host carbonate. Hydrozincite is a common oxidation product. Smithsonite is rarely present.

The mineralized unit contains 10 to 15% pale green to yellow sphalerite that occurs disseminated in the host carbonate, as bedding-parallel and bedding-normal veins and in crackle breccia. Gangue minerals include dolomite, calcite, and barite. Black, clay-rich dissolution seams are common and often contain remnant carbonate fragments to 1 cm diameter. Galena occurs near the top of the mineralized unit and in the overlying beds, and is commonly associated with barite (Fig. 5).

Previous drilling intersected mineralization in a dark grey, bioturbated dolomite with oolitic and oncolitic dolomites below. The host dolomite and occurrence of sphalerite in this horizon is similar to that found at TIC showing.

2005 Field Assessment

1. The topographic setting is conducive to exploration as there is water for drilling, and ground cover is good for geophysics.
2. Talus covers the strike and downdip continuation of mineralized interval.
3. Sphalerite occurs as veins and disseminations parallel to bedding and is interpreted as stratabound.
4. Sphalerite occurs as veins and as pervasive disseminations in host dolostone.
5. Significant Zn mineralization is present in two zones. The main zone (upper area) is 3 m (true thickness) and the lower zone is 2 m (true thickness). A 10 m thick, weakly mineralized, stratigraphic interval separates the two zones.
6. Zinc mineralization grades 10% Zn over 30 cm in small creek wash exposing main showing.
7. Extensive dissolution fabrics occur in the host carbonate rocks.

BEAR

Mineralization is hosted in dolomite of the Upper Ordovician to Silurian Whittaker Formation. The cliff-forming Whittaker Formation is 350 to 425 m thick. Exposed at the showing are medium- to dark-grey-weathering, coarse-grained dolarenite, stromatoporoid floatstone, and cherty dolomudstone. The beds are vuggy, with local crackle and mosaic breccia. Dolomite becomes more coarsely crystalline towards the mineralized zone.

Beds at the showing strike east-southeast and dip 30º southwest. Local drag folds and kinks are present in the mineralized zone. A northwest-southeast trending strike-slip? fault marks the northeastern limit of the showings. Folding in the mountain on the opposite side of the Twitya River shows a broad anticline with long northerly and southerly dipping limbs. The BEAR showing may be on a limb of this fold

Eleven mineralized occurrences have been mapped at the Bear showing. These define a linear trend normal to strike over a distance of 135 m and 15 to 20 m wide. Mineralization consists of red and white sphalerite, galena, and tetrahedrite with quartz, dolomite, barite and calcite (Fig. 6). Smithsonite locally replaces sphalerite. Mineralization occurs in bedding-parallel and bedding-perpendicular veins and only rarely replaces or is disseminated within the host carbonate.

Previously, 24 exploration holes were drilled on the property and intersected discontinuous Pb-Zn-Ag mineralization of grades similar to those in the surface showings. NORMIN database of mineral showings reports the best drill-core assay as: 8.97% Zn, 6.26% Pb, and 2.4 oz/t Ag over 3.8 m.

2005 Field Assessment

1. Mineralized zone is easily located and accessible.
2. Topography is moderate for the region.
3. Drilling setups range from easy to difficult.
4. Multiple sphalerite and galena showings occur over a 200 x 300 m area.
5. Mineralization trends northeasterly and cuts the northwest-striking beds at a high angle.
6. The Zn-Pb mineralization ranges from low to high grade and is visible in 12 significant known showings.
7. Three stages of sphalerite mineralization indicate a protracted hydrothermal fluid history.
8. Minor copper mineralization is present as malachite and azurite staining on tetrahedrite. This was not reported in the assessment files.
9. Solution brecciation and accompanying dolomitization extend well beyond the sulphide mineralization indicating that a sizable fluid event affected this area.

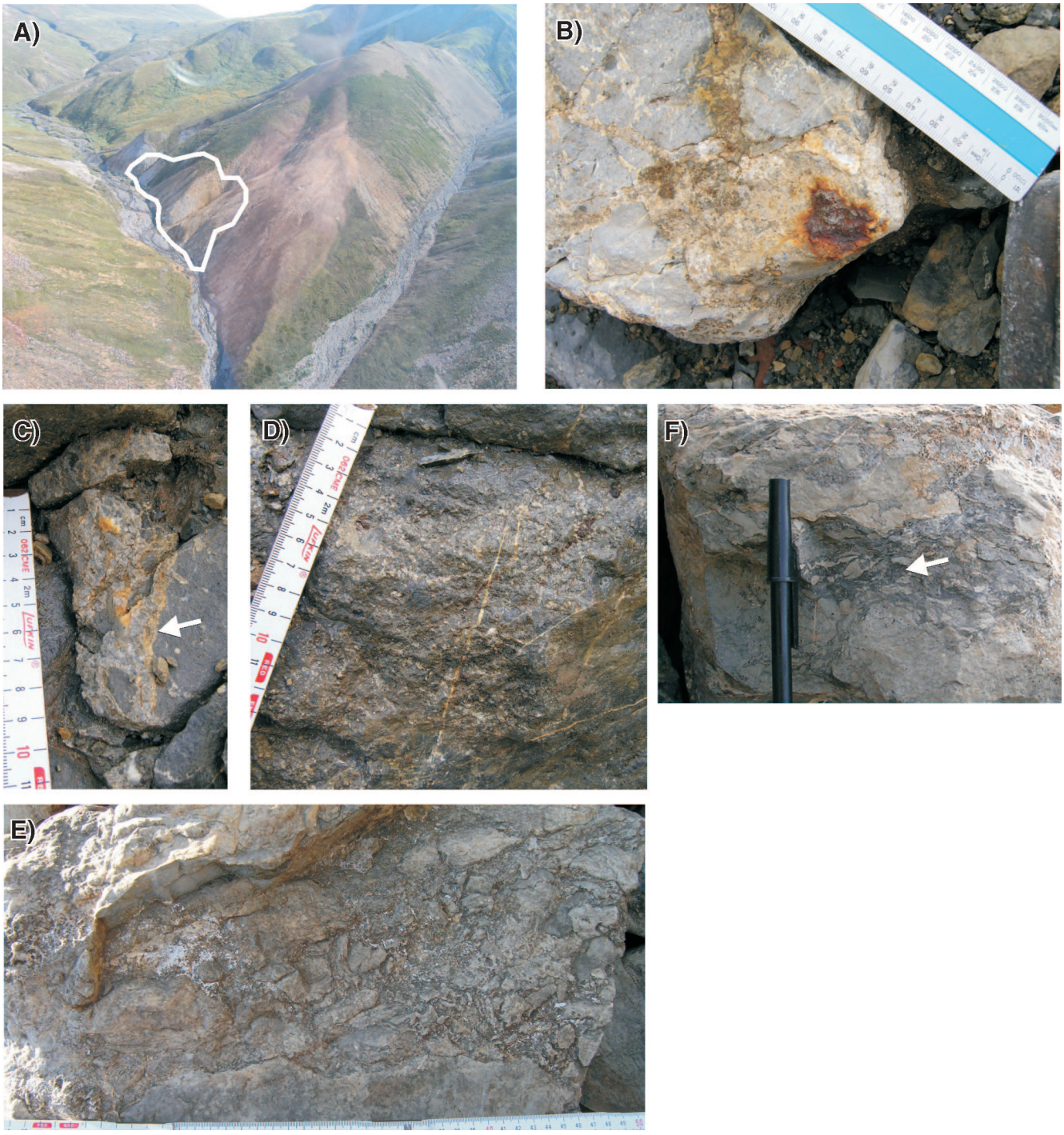

Figure 5. AB. **A)** View from the air of AB showing (white outline). Outcrop is limited in the valley and the lateral extent of this showing opposite side of the valley has not been determined. **B)** Brecciated dolostone with pyrite and sphalerite. Note the irregular, corroded margins on the breccia fragments. **C)** Fracture-controlled mineralization with abundant green sphalerite. Chemical interaction between the mineralizing fluid and the host carbonate rock is shown by the extensively corroded margins of the fracture (arrow). **D)** Yellow- green crystalline sphalerite disseminated within and replacing host carbonate rock. **E)** Dissolution breccia of carbonate fragments separated by black, argillaceous insoluble residue (arrow), sphalerite, and white-weathering zinc oxide and carbonate minerals. **F)** Dissolution seam of black, argillaceous, insoluble residue and remaining corroded fragments of carbonate.

10. Additional mineralization, down the hill from the known showings, indicates untested exploration potential.
11. The shallow-dipping beds are favourable caps which enhance fluid-bedding interaction in the mineralizing system.
12. This property was previously drilled and was found to lack both grade and size.

ART-EKWI

The ART and EKWI showings occur within light grey, medium-bedded, medium to coarsely crystalline limestone of the Landry Formation. The showings occur along a mineralized fault zone which separates Landry Formation from Headless Formation and is proximal to the hinge of a gently inclined anticline. Adjacent to the mineralization, the host carbonate contains abundant crackle breccia and jointing.

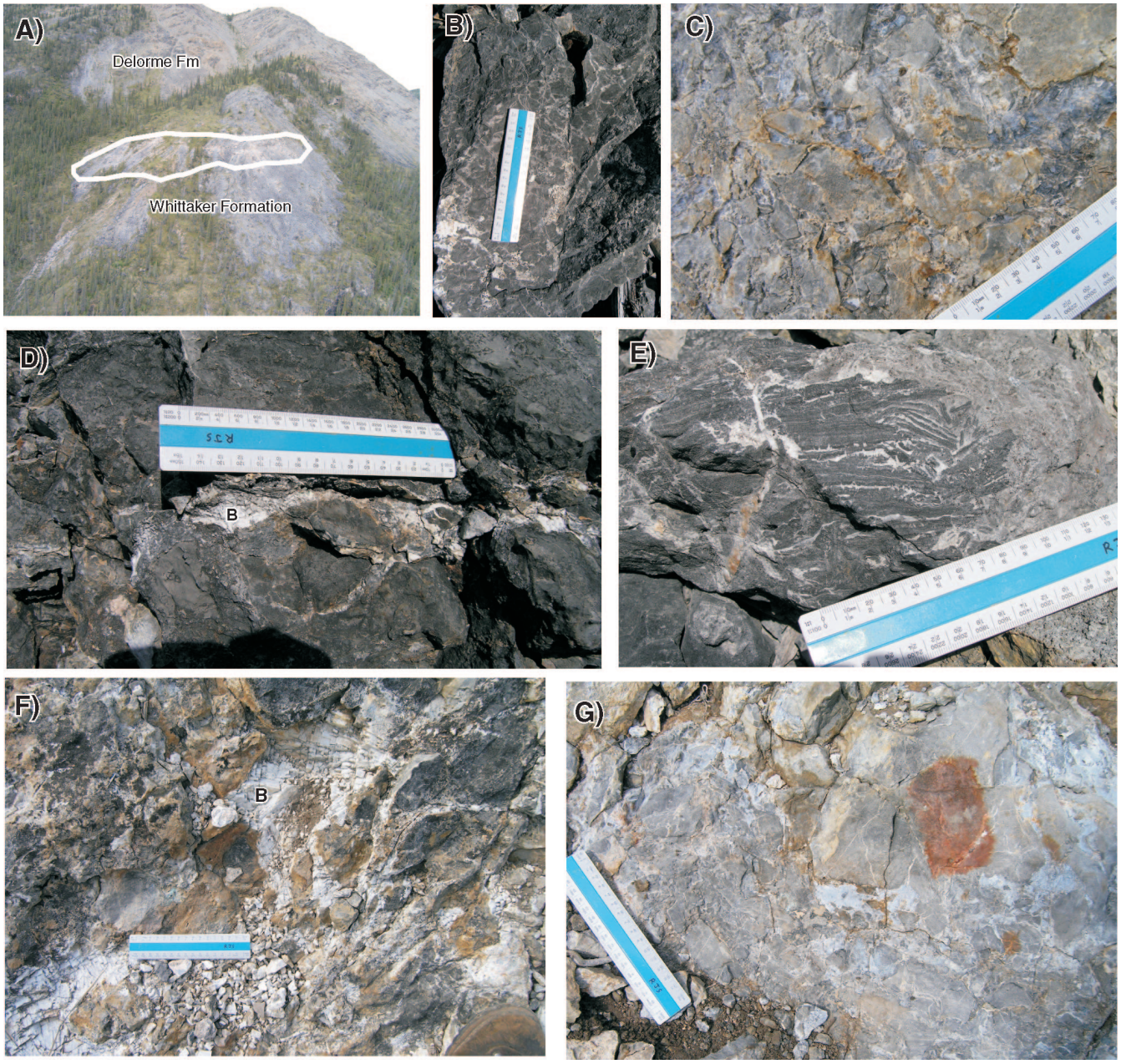

Figure 6. BEAR. **A)** View north from the air showing the extent of mineralization at the Bear showing (white outline). **B)** Unmineralized crackle to mosaic breccia in host Whittaker Formation dolostone. **C)** Weakly mineralized mosaic to rubble breccia cemented by quartz and sphalerite. **D)** Barite (B) and minor sphalerite in horizontal vein. **E)** Zebra dolomite. **F)** Barite (B) and minor sphalerite. **G)** Rubble breccia cemented by sparry dolomite, quartz, sphalerite.

The ART-EKWI showings are entirely mineralized rubble that occurs at intervals over a strike length of 1800 m. ART No. 1 is 5 to 7 m wide, dominated by smithsonite, anglesite, and cerussite with minor galena; sphalerite is absent. One drillhole intersected 3.5 m of mineralization that assayed 0.46% Pb and 43.0% Zn. The No. 2, 3, and 4 showings consist of zinc and lead carbonate minerals with minor sphalerite and galena. A drillhole completed on the No. 2 occurrence averaged 10.08% Pb+Zn over a true thickness of 15 m (Gutrath, 1974)

2005 Field Assessment

1. The showings are small. The largest is less than 20 by 7 m, as exposed on surface.
2. The showings are hosted in limestone and lack a significant alteration halo.
3. There is crackle brecciation, but there is no collapse breccia or solution rounding of fragments.
4. The area is rugged and the showings are located on a small saddle ridge at 2150 m a.s.l.
5. There is little space for a significant deposit.
6. There is no water easily accessible for drilling.
7. The showings are high grade, but consist of secondary zinc minerals (smithsonite) and galena with some secondary lead minerals.
8. The gossan occurs as a discontinuous trace extending 1.8 km along the hinge of a well exposed anticline.
9. The mineralization is easily traceable due to its pronounced gossan.

ICE

The ICE showings occur in steeply east-dipping dolostone of the Lower Cambrian Sekwi Formation. The lowest unit exposed is a thick-bedded quartz arenite with abundant *Skolithos* burrows. This is overlain by light grey, medium-bedded, finely crystalline limestone with horizontal burrows. Mineralization is hosted in red-weathering, thick-bedded, medium-crystalline dolarenite with intraclasts and crossbedded sandy layers. Minor faulting is visible in the outcrop to the north.

The ICE-9 showing is exposed over a strike length of 12 m with a true thickness of 6 m, but it is covered by talus at both ends. Mineralization occurs as yellow-brown porous blocks, about 20 cm^2, of smithsonite and galena with very minor native sulphur. Galena is abundant and is locally disseminated within the smithsonite and reaches 2 cm across, and also occurs in small networks of fracture veins up to 2 mm across. Minor breccias consisting of angular to subangular, poorly sorted dolostone fragments occur in the surrounding dolostone. One hole was drilled in 1974 to test downdip. No mineralization was intersected (McGregor and Helmstaedt, 1974).

2005 Field Assessment

1. Blocks of smithsonite and galena are found in talus over 18 m vertically and 7 m across.
2. The shape of the smithsonite blocks is suggestive of bedding-parallel replacement.
3. The geology of the property is easy to interpret.
4. The host rocks are altered to medium to coarsely crystalline dolomite.
5. Boulders of brecciated carbonate are visible in talus.
6. There are 11 similar Zn-Pb occurrences in talus along strike.
7. No dissolution fabrics are present in the mineralized talus rubble.
8. The mineralization is terminated by erosion to the south, but the trend continues as discontinuous small occurrences over 37.5 km to the north.

KEG

The principal showing on the KEG property contains blocks of locally fossiliferous, black dolostone, and chert that is partially replaced by crystalline and botryoidal pyrite and brown to greenish-yellow sphalerite.

Three diamond-drill holes were completed, the best intersection assaying 4.18% Zn and 0.05% Pb across 8.2 m in Hole 73-K-3 (Adamson, 1973).

Sunblood and Whittaker formations are exposed in the valley walls. The base of the valley contains exposures of thickly bedded black dolostone with abundant stromatoporoids and crinoid ossicles. This dolostone is either a fossiliferous member of the middle or lower Sunblood Formation, or a Devonian unit over which the Sunblood Formation has been thrust. A steeply dipping, northwest-trending fault appears to run along the length of the valley and may have provided a focusing mechanism for hydrothermal mineralizing fluids. The porous and permeable fossiliferous beds were suitable hosts for sulphide mineralization.

2005 Field Assessment

1. The mineralization is mainly pyrite, but locally contains crystalline sphalerite (about 5% Zn over 30 cm).
2. Stratigraphy is probably the lower Sunblood Formation.
3. Host rock is black dolomite with stromatoporoids.
4. Mineralization occurs on a structure that runs the length of the valley (3 km).

5. Mineralization is entirely in talus but appears to occur over a narrow width (3 m).
6. Core is still onsite and intact, but labels are missing.
7. Very minor mineralization occurs in the coarse talus of the upper Sunblood Formation, farther up the hill.
8. Dissolution fabrics are absent in the host dolomite.
9. Only minor sparry dolomite was noted.
10. Brecciation of host rocks appears tectonic, and predates the Zn-Pb mineralization.
11. Topographic setting is conducive for hosting a sizable 'blind' deposit as well as being favourable for geophysics and diamond drilling.

RAIN Zone 3

The RAIN and SNOW showings consist of 20 Pb-Zn sulphide occurrences grouped into three zones. Mineralization occurs in the Devonian Arnica and Landry formations with minor vein occurrences in the Ordovician-Silurian Whittaker Formation. The RAIN 3 group of showings is situated on the steeply dipping east limb of a northwest-trending, open, asymmetric synclinorium. Mineralization occurs sporadically along strike within Devonian dolomite of the Landry Formation.

Sphalerite and galena mineralization is commonly associated with faulting and is contained within vugs, fracture zones, and breccia pods within the Arnica Formation and less commonly Whittaker Formation dolomites. Three drillholes and sampling indicate that mineralization is patchy and discontinuous.

The RAIN 3 group of showings consists of eight Zn-Pb occurrences, the most significant of which is the No. 15 showing. It consists of small areas of crackle breccia 1 to 5 mm wide, roughly perpendicular to bedding and filled with dolospar. Five to 10 cm wide zones of mosaic breccia containing angular to subangular blocks, locally with scalloped margins, are cemented by sparry dolomite. Sphalerite is rare and occurs as brown crystals up to 1 cm across. Zinc oxide minerals are a common alteration product. The field examination failed to find what the assessment file describes as a 40 m length of discontinuous calcite veining up to 30 cm wide and striking subparallel to northwest-trending bedding (Swinden, 1973).

2005 Field Assessment

1. The showings cover a small area.
2. Sphalerite is uncommon in the altered area, generally less than 1%.
3. Galena and pyrite have not been identified.
4. Minor amounts of malachite are present.
5. Alteration is represented by a weak crackle breccia.
6. The host rocks are converted to finely crystalline dolomite within the immediate vicinity of the showings.
7. There are multiple showings along strike. (There are a total of seven showings between RAIN and SNOW over 5 km of strike length).
8. The structure is obvious and well defined.
9. Beds are steeply dipping and mineralization appears to have a relationship to regional structure.
10. The mineralized trend has relatively easy access for mapping and prospecting.

TAP No. 1

Zinc-lead mineralization occurs in dark gray to black, thinly bedded, fine-grained dolowackestone with crinoids. Coral- and stromatoporoid-bearing blocks in the creek are probably not from the mineralized unit.

Mineralization occurs as fault-related pyrite-dolomite veins and crackle breccia that contain minor amounts of disseminated sphalerite and galena, and as bedding-parallel disseminated pyrite associated with porous beds. Quartz-calcite-sphalerite±barite veins varying in width from hairline fractures to 10 cm occur over a 60 m stratigraphic thickness, intermittently over a strike length of 750 m. One drillhole was completed on this showing in 1974; assays returned 0.40% Zn over 1.2 m (Royle and Leary, 1974).

2005 Field Assessment

1. Pyrite occurs in bedding-parallel veins up to 5 cm wide.
2. Sphalerite was only found in narrow (1 to 5 mm wide) quartz-calcite veins that are 30 cm to 1 m apart.
3. Abundant crackle breccia cuts through the outcrop but is not mineralized.
4. The mineralization is only observed over about 3 m of stratigraphic thickness.
5. No other rusty stains were noted in the creek.

CONCLUSIONS

The best targets for further exploration are considered to be showings hosted in limestone (at the time of mineralization) rather than dolostone; that exhibit strong chemical interaction between the host rock and fluid resulting in carbonate dissolution, or replacement; and that have multiple generations of sphalerite and galena (Sharp and Dewing, 2004). Based on the 2005 field examination, the BEAR, GAYNA, AB, and TIC showings are considered the most attractive

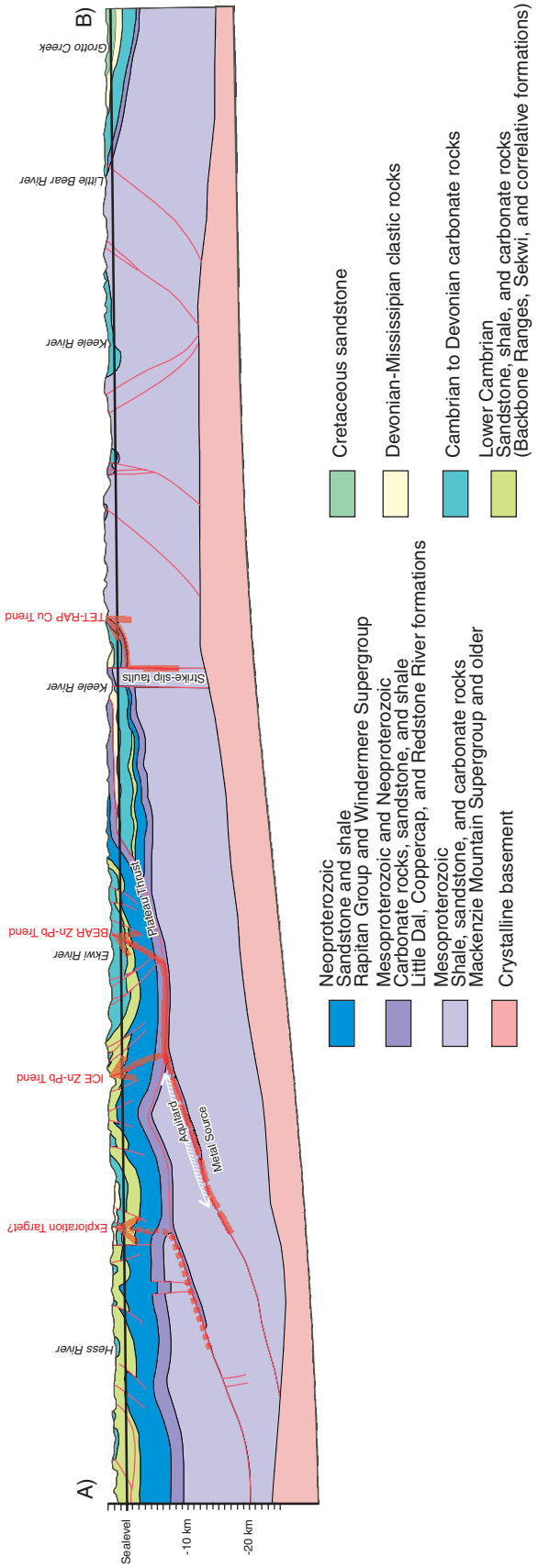

Figure 7. Structural cross-section after Cecile and Cook (1981). Possible fluid migration pathways are depicted in red. The ICE trend of Zn-Pb showings occurs above the termination of a Proterozoic thrust panel. Areas above the termination of other thrust panels are potential exploration areas.

exploration targets because they have complex paragenesis, multiple generations of mineralization, evidence of dissolution, and replacement of the host rock.

Zinc-lead showings occur in structurally controlled linear belts (Fig. 1). Comparing the faults that occur adjacent to mineral showings with the structural cross-section shows that the showings on the 'Ice' belt occur on a back thrust immediately above the termination of a large thrust panel of Proterozoic strata (Fig 7). This would suggest that the faults above the termination of a large thrust panel should be favourable exploration targets.

Showings in the PALM-TIC belt occur at the inflection point between the Devonian-cored synform to the west and Proterozoic-cored antiform to the east. This particular Zn-Pb belt appears to be related to a ramp in the underlying Plateau Thrust.

ACKNOWLEDGMENTS

This work was undertaken as part of an agreement between Eagle Plains Resources Ltd. and Earth Sciences Sector, under Project Y13, 'The Mackenzie Corridor: Access to Northern Resources' in the Northern Resource Development Program. Thanks to Dechenla Lodge, and Fireweed Helicopters for help in the field. David Scott and Susan Mrak help shepherd this activity into the GSC program. Many thanks to Chuck Downie and Tim Termunde at Eagle Plains Resources for their support. Peter Hannigan is thanked for a thorough and thoughtful review. Thanks also to Robert MacNaughton for his help with stratigraphy. This is Northwest Territories Geoscience Office Contribution #0023.

REFERENCES

Adamson, T.J.
1973: KEG Group - Report on 1973 fieldwork; Mackenzie Mining District, Northwest Territories, Department of Indian and Northern Development, Mineral Assessment File 80318, 28 p.

Aitken, J.D.
1993: Cambrian and Lower Ordovician, Sauk Sequence; *in* Chapter 4 of Sedimentary Cover of the Craton in Canada, (ed.) D.F. Stott and J.D. Aitken; Geological Survey of Canada, Geology of Canada, no. 5, p. 96–124 (also Geological Society of America, Geology of North America, v. D-1, p. 96–124).

Aitken, J.D. and Cook, D.G.
1974: Bedrock geology, Mount Eduni, Bonnet Plume, Yukon and District of Mackenzie;Geological Survey of Canada, Open File 221, scale 1:250 000.

Aitken, J.D. and McMechan, M.E.
1991: Middle Proterozoic assemblages; Chapter 5 *in* Geology of the Cordilleran Orogen in Canada, (ed.) H. Gabrielse and C.J. Yorath; Geological Survey of Canada, Geology of Canada, no. 4, p. 99–124 (also Geological Society of America, Geology of North America, v. G-2, p. 99–124).

Blusson, S.L.
1972: Sekwi Mountain map area, Yukon and Mackenzie District; Geological Survey of Canada, Map 1333A, scale 1:250 000.
1974: Five geological maps of northern Selwyn Basin (Operation Stewart), Yukon Territory and District of Mackenzie, N.W.T.; Geological Survey of Canada, Open File 205, scale 1:250 000.

Carrière, J. J. and Sangster, D.F.
1999: A multidisciplinary study of carbonate-hosted zinc-lead mineralization in the Mackenzie Platform (a.k.a. Blackwater and Lac de Bois platforms) Yukon and Northwest Territories, Canada; Geological Survey of Canada, Open File 3700, 145 p.

Cecile, M.P. and Cook D.G.
1981: Structural cross section northern Selwyn and Mackenzie Mountains, Yukon and District of Mackenzie; Geological Survey of Canada, Open File 807.

Cook, D.G. and Aitken, J.D.
1978: Twitya Uplift: A pre-Delorme phase of the Mackenzie Arch; Geological Survey of Canada; in Current Research, Part A; Geological Survey of Canada, Paper 78-1A, p. 383–388.

Fritz, W.H., Cecile, M.P., Nordord, B.S., Morrow, D., and Geldsetzer, H.H.J.
1991: Cambrian to Middle Devonian assemblages. ; Chapter 7 *in* Geology of the Cordilleran Orogen in Canada, (ed.) H. Gabrielse and C.J. Yorath; Geological Survey of Canada, Geology of Canada, no. 4, p. 151–218 (also Geological Society of America, Geology of North America, v. G-2, p. 151–218).

Godwin, C.I., Sinclair, A.J., and Ryan, B.D.
1981: Lead isotope models for the genesis of carbonate-hosted Zn-Pb, shale-hosted Ba-Zn-Pb, and silver-rich deposits in the northern Canadian Cordillera; *in* Proceedings of the Symposium on Mineral Deposits of the Pacific Northwest, (ed.) M.L. Silberman, C.W. Field, and A.L. Berry; United States Geological Survey, Open File Report 81-0355, p. 129–152.

Gordey, S.P., and Makepeace, A.J.
2003: Yukon digital geology, Version 2.0; Geological Survey of Canada, Open File 1749, scale 1:1 000 000.

Gutrath, G.C.
1974: Report on the ART-EKWI property, Godlin Lakes District, Northwest Territories; Department of Indian Affairs and Northern Development, Mineral Assessment File 80394, 30 p.

MacNaughton, R.B, Narbonne, G.M., and Dalrymple, R.W.
2000: Neoproterozoic slope deposits, Mackenzie Mountains, northwestern Canada: implications for passive-margin development and Ediacaran faunal ecology; Canadian Journal of Earth Sciences, v. 37, p. 997–1020.

McGregor, J.A. and Helmstaedt, H.
1974: Geological Investigration of the ICE-EMILY claim group, Mackenzie Mountains Northwest Territories Department of Indian Affairs and Northern Development, Mineral Assessment File 80357, 19 p.

Narbonne, G.M. and Aitken, J.D.
1995: Neoproterozoic of the Mackenzie Mountains, northwestern Canada; Precambrian Research, v.73, no.1–4, p.101–121.

Ronning, P.
1975: A geological report with a drilling survey on the TIC-TIL mineral claims, 16 miles WNW of Palmer Lake, Mackenzie Mining District, Northwest Territories. Department of Indian Affairs and Northern Development, Mineral Assessment File 80499, 26 p.

Royle, D.Z. and Leary, G.M.
1974: Geology Report — Tap-Glug Claims; Department of Indian Affairs and Northern Development, Mineral Assessment File 80365, 27 p.

Sharp, R.J. and Dewing, K.
2004: Dolomitization and brecciation at the Mississippi-Valley type Zn-Pb Polaris Mine, central Arctic Islands, Nunavut; *in* Dolomites: The Spectrum — Mechanisms, Models, Reservoir Development, (ed.) J.J. Packard and G.R. Davies; Canadian Society of Petroleum Geology, Core Conference, 27 p.

Swinden, H.S.
1973: Welcome North Project Final Report; Department of Indian Affairs and Northern Development, Mineral Assessment File 80334, 28 p.

Geological Survey of Canada Project Y13