Geological Survey of Canada

CURRENT RESEARCH
2003-C16

Iron-formation–hosted gold occurrences in the Ellice Hills area, Committee Bay belt, Nunavut

Cari Deyell and Ross L. Sherlock

2003

Natural Resources Canada
Ressources naturelles Canada

Canada

CURRENT RESEARCH

ISSN 1701-4387
Catalogue No. M44-2003/C16E-IN
ISBN 0-662-33538-4

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

A free digital download of this publication is available from the Geological Survey of
Canada Bookstore web site:

http://gsc.nrcan.gc.ca/bookstore/

Click on Free Download.

Authors' addresses

C. Deyell (cdeyell@utas.edu.au)
Centre for Ore Deposit Research
University of Tasmania, Hobart, Tasmania

R.L. Sherlock (sherlock@nrcan.gc.ca)
626 Tumiit Building, P.O. Box 2319
Iqaluit, Nunavut
X0A 0H0

Publication approved by Canada-Nunavut Geoscience Office

Iron-formation–hosted gold occurrences in the Ellice Hills area, Committee Bay belt, Nunavut[1]

Cari Deyell and Ross L. Sherlock

Deyell, C. and Sherlock, R.L., 2003: Iron-formation–hosted gold occurrences in the Ellice Hills area, Committee Bay belt, Nunavut; Geological Survey of Canada, Current Research 2003-C16, 11 p.

Abstract: The supracrustal rocks of the Committee Bay belt are dominated by clastic sedimentary rocks, ultramafic flows and intrusions, iron-formation, and quartz arenite, with lesser amounts of mafic to felsic volcanic rocks. In the Ellice Hills area, three iron-formation–hosted gold prospects are recognized: the Inuk, Mist-Koffy, and Peanut showings. In these occurrences, gold mineralization is localized in areas where progressive D_2 deformation has resulted in dilational settings, either at lithological contacts within high-strain zones or in the hinges of F_2 folds. These dilational settings allowed for synkinematic alteration and gold introduction associated with sulphidation of iron-formation. These structural/stratigraphic settings are similar to those of gold deposits in the Hayes River area of the Committee Bay belt, and those of the Meadowbank deposits of the Woodburn Lake group. Initial interpretation of the deformation fabrics suggest that much of the iron-formation–hosted gold mineralization in the Committee Bay belt may be Paleoproterozoic in age.

Résumé : Les roches supracrustales de la ceinture de Committee Bay sont constituées en prédominance de roches sédimentaires clastiques, de coulées et d'intrusions ultramafiques, de formations de fer et d'arénites quartzeuses. On y trouve aussi en moindres quantités des roches volcaniques de composition mafique à felsique. Dans la région des collines Ellice, trois gîtes aurifères dans des formations de fer ont été identifiés : les indices Inuk, Mist-Koffy et Peanut. Dans ces gîtes, la minéralisation aurifère se situe à des endroits où la déformation progressive D_2 a engendré des cadres de dilatation, soit aux contacts lithologiques dans des zones d'intense déformation, soit dans les charnières de plis P_2. Ces cadres de dilatation ont permis une altération syncinématique et l'ajout d'or associés à la sulfuration des formations de fer. Ces cadres structuraux/ stratigraphiques sont similaires à ceux des gisements d'or de la région de la rivière Hayes, dans la ceinture de Committee Bay, et des gîtes de Meadowbank, dans le groupe de Woodburn Lake. L'interprétation initiale des fabriques de déformation laisse croire que la minéralisation aurifère dans les formations de fer de la ceinture de Committee Bay pourrait dater du Paléoprotérozoïque.

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

INTRODUCTION

The Committee Bay belt forms part of the north-central extension of an approximately 2000 km long belt of plutonic and supracrustal rocks that extends from northern Saskatchewan through the Committee Bay region to north-central Baffin Island (Fig. 1A, 1B). The supracrustal rocks in the Committee Bay region, collectively referred to as the Prince Albert group, are dominated by clastic sedimentary rocks, ultramafic flows and intrusions, iron-formation, and quartz arenite, with lesser amounts of mafic to felsic volcanic rocks. These rocks are prospective for different commodities and mineral-deposit types — most notably, gold associated with iron-formation, and nickel-copper (± platinum-group elements) associated with ultramafic intrusions and flows. The diamond potential of this area remains unquantified. The Committee Bay belt has been explored intermittently since 1970 (Sherlock and Deyell, 2002); more recently, exploration by Apex Geoscience Ltd. (conducted since the early 1990s) has identified several gold showings in the Laughland Lake (NTS 56 K), Hayes River (NTS 56 J), and Ellice Hills (NTS 56 P) areas.

This contribution reports preliminary observations and interpretations of the geological setting and timing of gold mineralization in three auriferous iron-formations in the Ellice Hills area (NTS 56 P): the Inuk, Mist-Koffy, and Peanut prospects (Fig. 1C). The three Ellice Hills occurrences are compared with similar iron-formation–hosted gold occurrences in the Hayes River area (NTS 56 J), previously reported on by Hyde et al. (2002), and with the Meadowbank deposits of the Woodburn Lake group (Sherlock et al., 2001a, b). This work was completed during the 2002 field season, as part of the Committee Bay Targeted Geoscience Initiative project.

REGIONAL GEOLOGY OF THE COMMITTEE BAY BELT

The Prince Albert group occurs as coherent, northeast-striking strands of supracrustal rocks up to 15 km wide, and also as northeast-trending discontinuous rafts of supracrustal rocks included within plutonic rocks (Fig. 1C). Current constraints on the Prince Albert group (*see also* Sanborn-Barrie et al., 2002a, b, 2003; Sandeman et al., 2001a, b; Skulski et al., 2002, 2003) indicate that a lower, volcanic-dominated sequence of intercalated basalt and ca. 2.732 Ga felsic volcanic rocks is overlain by a (~300 m thick) komatiite sequence. An upper, sedimentary-dominated sequence of psammite, semipelite, and quartzite was deposited between ca. 2.72 and 2.711 Ga, the younger age being constrained by an overlying intermediate tuff. The uppermost part of the supracrustal sequence consists of minor komatiite, iron-formation, and younger (<ca. 2.69 Ga) clastic rocks that locally contain granulite-facies metamorphic mineral assemblages. Iron-formation appears to have been deposited mainly in two stratigraphic intervals, interpreted as reflecting submarine hydrothermal systems active between and after ca. 2.73 Ga and ca. 2.71 Ga volcanism. The supracrustal sequence is intruded by foliated tonalite to granodiorite (biotite±hornblende±magnetite±titanite), abundant monzogranite pegmatitic veins, and potassium-feldspar–megacrystic to augen monzogranite. The plutonic rocks generally form two suites, at 2720 to 2700 Ma and 2610 to 2580 Ma (H. Sandeman, pers. comm., 2002).

The metamorphic grade of the granite-greenstone domain is variable, but typically increases from lower amphibolite facies in the southwest (Laughland Lake region) to upper amphibolite facies in the northeast (Ellice Hills area). Lower–granulite-facies metasedimentary rocks are limited to the northern paragneiss domain in the Arrowsmith River region (NTS 56-O; Skulski et al., 2002).

The Committee Bay area has been affected by two penetrative deformation events, by polymetamorphism, and by localized shortening (folding ± shearing; Sanborn Barrie et al., 2002b, 2003). D_1 involved development of north-northwest–trending, likely west-verging folds and associated LS fabrics that affect both Prince Albert group strata and widespread ca. 2.6 Ga plutonic rocks (Sanborn-Barrie et al., 2002b, 2003). D_2 structures dominate the structural fabric of the belt and are most easily recognized in the supracrustal rocks. These fabrics are by far the most common and have had the greatest impact on the geometry of the belt. All known gold-mineralization occurrences in the belt, including those described below, are interpreted to be synkinematic with D_2 deformation. D_2 fabrics include northeast-trending folds (F_2), northeast-striking composite transposition foliation (S_2±S_1), and shallowly (<34°) plunging stretching lineations (L_2). F_2 folds are commonly upright to northwest-verging, and plunge both to the northeast and southwest. S_2 (±S_1) planes are mainly southeast-dipping, consistent with northwest-directed shortening during D_2 (Sanborn-Barrie et al., 2002b, 2003). The final product of D_2 deformation is expressed as two east-striking fault zones: the dextral, oblique-slip Amer fault zone in the southwestern part of the area, and the dextral strike-slip Walker Lake shear zone through the centre of the belt. D_3 folds are sporadically developed, with approximately north-south–trending upright axial planes and poorly developed planar fabrics.

ELLICE HILLS GOLD OCCURRENCES

Mineral exploration in the Ellice Hills region prior to the 1990s was limited to reconnaissance work, mainly directed towards Cu and Ni mineralization, in the Kinngalugjuaq Mountain, Mist-Koffy, and Mitten Lake areas, by King Resources Company. In 1992, the Committee Bay Joint Venture (CBJV) began exploring for gold and was successful in identifying several new gold occurrences. In the Ellice Hills area, three main gold showings have been identified, all of which occur in or near the main Committee Bay supracrustal belt. These include the Inuk showing, the Mist-Koffy area, and the Peanut prospect. Detailed mapping at each of these showings was undertaken to constrain the geological setting and timing of gold mineralization relative to regional deformation events. Results of the mapping program and preliminary interpretations for each of the three showings are summarized below.

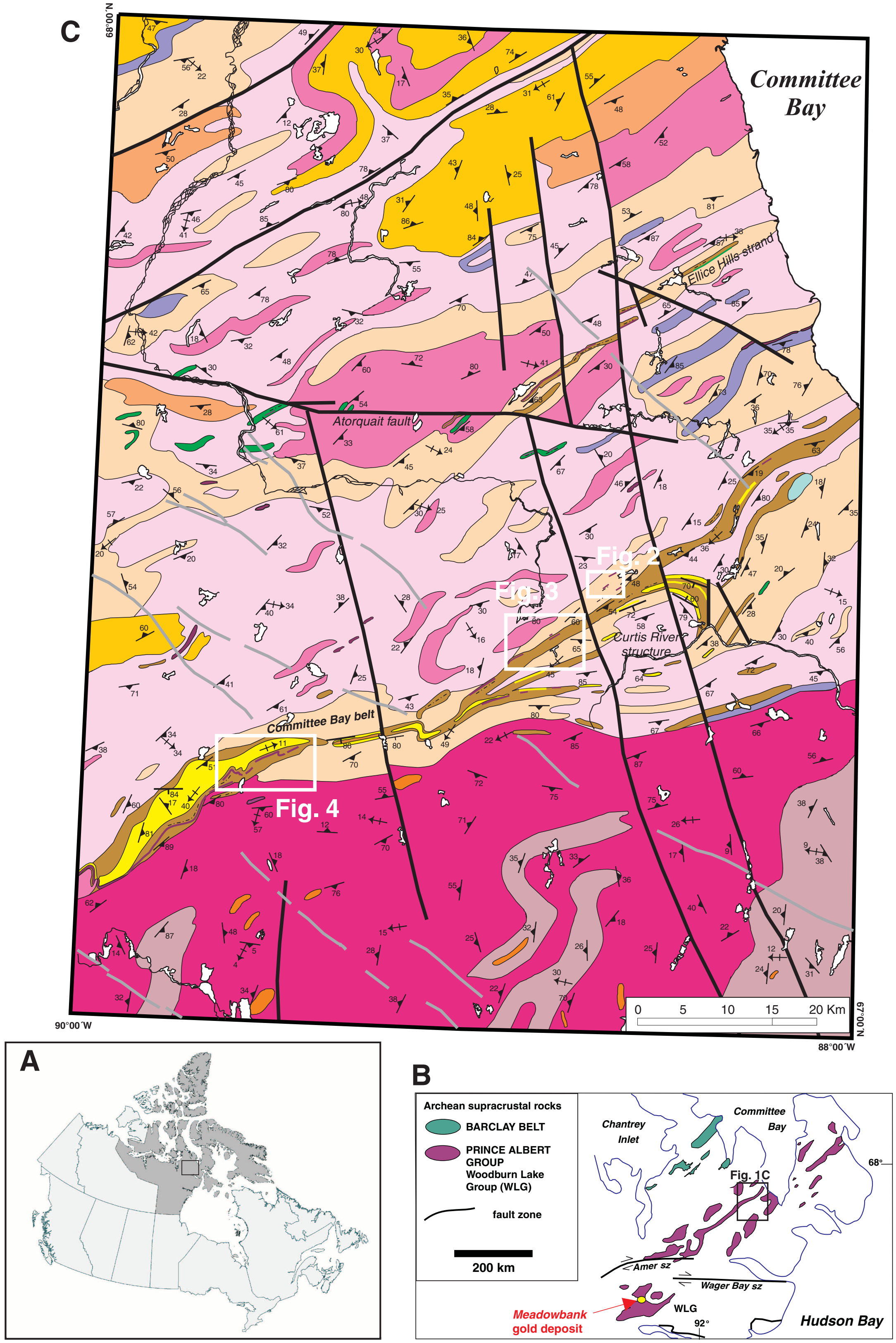

Figure 1. ***A***. *Map of Canada with Nunavut shaded. Square shows location of Figure 1B.* ***B***. *Location of Archean supracrustal rocks in the Rae structural subprovince. The rectangle outlines the Ellice Hills map area, mapped in 2002. The location of the Meadowbank iron-formation–hosted gold deposit is shown. sz = shear zone.* Modified from *Sandeman et al. (2001a).* ***C***. *Generalized geology of the Ellice Hills (NTS 56 P) map area.* From *Skulski et al. (2003).* ***D***. *Legend for Figures 1–4.*

Figure 1D. Common legend for Figures 1 to 4.

Proterozoic

- Mackenzie diabase dykes (ca. 1267 Ma)
- Hudsonian monzogranite; salmon to orange, biotite+magnetite±fluorite monzogranite, massive to locally variably foliated, contains abundant inclusions of older lithologies
- Fine- to medium-grained, millimetre-scale–laminated, reddish arenites interbedded with metre-scale bedded calc-silicate rocks inferred to be silliceous marble. Folster Lake Group equivalent?

Archean

- Fine- to medium-grained, white to pink, variably foliated and lineated, biotite±magnetite monzogranite
- Medium-grained, white to buff, variably foliated and lineated, biotite+muscovite, locally potassium-feldspar – phyric monzogranite to syenogranite
- Medium- to coarse-grained, weakly to moderately foliated and lineated, biotite±magnetite, potassium-feldspar–megacrystic granodiorite to monzogranite
- Walker Lake intrusive complex; foliated, reddened biotite+magnetite±hornblende, potassium-feldspar–megacrystic to augen granodiorite to monzogranite (ca. 2610 Ma), crosscut by Hudsonian monzogranite (ca. 1820 Ma)
- Medium-grained, grey to pink, variably foliated and lineated, biotite±hornblende±magnetite, weakly potassium-feldspar–phyric granodiorite to monzogranite
- Medium-grained, grey to pink, locally gneissic but typically variably foliated and lineated, biotite±hornblende±magnetite tonalite
- Typically medium- to coarse-grained, variably foliated and lineated, hornblende±magnetite diorite and rare gabbro
- Fine- to medium-grained, strongly foliated and gneissic, biotite±hornblende±magnetite granodiorite with abundant schlieren and inclusions of amphibolite, tonalite, diorite and semipelite
- Undifferentiated plutonic rocks (Fig. 2–4)

Prince Albert group

relative age inferred

- Undivided Prince Albert group, including abundant semipelite and psammite, minor pelite and intermediate volcanic rocks
- Quartz arenite; centimetre- to decimetre-scale bedded units, locally cross-bedded and fuchsitic
- Iron-formation; undivided silicate-, oxide-, and rare sulphide facies (Fig. 2–4)
- Komatiite and undivided ultramafic schist and probable intrusions; komatiite is locally spinifex- and/or cumulate-textured
- Amphibolite, and amphibolitic and locally ultramafic schist; some represent mafic volcanic rocks

- lithological contact (approximate)
- fault
- 84 foliation (generation unspecified)
- 4 lineation (generation unspecified)
- 30 bedding (tops known)
- 80 fold axes, asymmetry indicated (Fig. 2–4)
- Trace of fold axes (Fig. 2–4)

Inuk occurrence

The Inuk prospect is located about 30 km inland from Committee Bay, and is hosted in an isolated raft of supracrustal rocks about 2 km northwest of the main supracrustal belt (Fig. 1C, 2A). The showing, discovered by prospecting, was drilled in six locations in 1997. Gold values in iron-formation from surface samples reach a maximum of 1893.55 g Au/t, with drill intercepts of 27.5 g Au/t over 0.99 metres and 11.2 g Au/t over 5.97 metres (Freeman and Wyllie, 2002).

Supracrustal units at Inuk consist of ultramafic rocks, iron-formation, and clastic metasedimentary rocks, all intruded by plutonic rocks. The supracrustal rocks and a biotite granodiorite are interlayered and have been deformed into a moderately to steeply north-northeast–plunging tight fold (Fig. 2A).

The iron-formation is up to 15 m thick and is dominated by millimetre- to centimetre-scale alternating layers of magnetite and quartz, interbedded with amphibole- and biotite-bearing intervals in roughly equal amounts. Garnet-bearing layers are also present. The unit locally displays pervasive silicification, which manifests as dark to black, glassy quartz with heavily disseminated iron sulphides (Fig. 2B). Structurally overlying the iron-formation are strongly foliated ultramafic rocks, consisting of talc-anthophyllite schist, which can be traced around the Inuk fold structure. Biotite semipelite outcrops between iron-formation and ultramafic rocks to the east-northeast of the showing, but is not recognized in the Inuk fold structure.

The supracrustal package in the Inuk area is intruded by a moderately foliated biotite granodiorite. The plutonic rocks (undifferentiated in Fig. 2A for clarity), which completely surround the supracrustal rocks, consist of biotite granodiorite to tonalite, with up to 20% metasedimentary rafts. The Inuk showing, and several discontinuous outcrops of metasedimentary and/or metavolcanic rocks (Fig. 2A), are interpreted to be xenoliths, isolated from the main Committee Bay belt during emplacement of the granodioritic to tonalitic rocks.

The main fabric in the area is a strong, typically moderately dipping, penetrative foliation that is interpreted to represent a composite $S_2 \pm S_1$ transposition fabric. Tight to isoclinal, rootless folds (F_1) are well developed in the iron-formation, but are not recognized in other supracrustal units. A planar (S_1/S_0) fabric wraps around the Inuk showing, defining a northeastward (~045°) trending, steeply plunging (~80°), tight F_2 fold (Fig. 2C, 2D) which deforms the supracrustal rocks and the biotite granodiorite. The regional $S_2 \pm S_1$ fabric is axial-planar to the F_2 structure, and the latest D_2 deformation involved the development of high-strain (shear) zones, trending on average ~035°, roughly axial-planar to F_2 (Fig. 2C, 2D). These shears are easily recognized in the iron-formation, because a narrow halo of sulphides commonly occurs around these structures, and minor offsets of the iron-formation bands are visible. Penetrative D_3 fabrics have not been recognized in the area.

Gold at Inuk is contained within sulphidic and silicified iron-formation (R.J. Wyllie and J. Williamson, unpub. report, 1997). The bulk of the mineralization is located at the lithological contact between structurally overlying ultramafic rocks and underlying iron-formation (Fig. 2D). The localization of gold at this contact, within the hinge of an F_2 fold, suggests that alteration and mineralization were syn-D_2. During folding, this contact would have been a dilational site allowing access of hydrothermal fluids, leading to alteration and mineralization. In support of this hypothesis, we observed small (D_2) shear zones (axial-planar to F_2), commonly surrounded by narrow auriferous sulphidation halos (Fig. 2C).

Mist-Koffy area

The Mist-Koffy area is located about 15 km to the southwest of the Inuk prospect in the Committee Bay supracrustal belt. The showings occur in two discrete zones (Fig. 1C, 3A) separated by overburden, with only scattered bedrock exposures. Maximum gold assays are 31.29 and 334.15 g Au/t for Mist and Koffy, respectively (Freeman and Wyllie, 2002). Additional anomalous gold assays (> 1 g Au/t) were recorded at several locations throughout the area (Hurley and Williamson, 1995).

Supracrustal rocks in the Mist-Koffy area (Fig. 3A) consist of clastic sedimentary rocks (semipelite to psammite) interbedded with ultramafic rocks, quartz arenite, and thin intervals of iron-formation. Clastic sedimentary rocks vary from garnet- and biotite-rich semipelite (with local sillimanite and rare muscovite) to biotite-bearing psammite. Ultramafic rocks are restricted to the northern edge of the supracrustal package, and consist of variably foliated ultramafic rocks that locally contain large orthopyroxene megacrysts. Rare mafic intrusive rocks (plagioclase-amphibole-clinopyroxene) outcrop in the Mist area, but cannot be traced to the southwest. The quartz arenite is fine- to medium grained, with locally abundant sillimanite and minor fuchsite.

Iron-formation in the southwestern part of the Mist-Koffy area occurs as thin (2–5 m) intervals interbedded with either ultramafic rocks or clastic sedimentary rocks (Fig. 3B). These units, particularly where intercalated with ultramafic rocks, can be traced intermittently along strike for 1 to 2 km. Further to the northeast, near Mist, thicker units (up to 20 m) of iron-formation occur as large, rust-coloured outcrops. The iron-formation consists of centimetre-scale amphibole-, biotite-, and/or garnet-bearing bands interbedded with quartz- and magnetite-dominated bands. Where they are auriferous, the iron-formation units contain several per cent disseminated pyrite and pyrrhotite. The supracrustal rocks are intruded by thin dykes of biotite-monzogranite pegmatite and are surrounded by a larger biotite±hornblende granodiorite body (plutonic rocks are undifferentiated for clarity in Fig. 3A).

The main fabric throughout the Mist-Koffy area is a strong northeast-southwest–trending foliation that is interpreted as a composite $S_2 \pm S_1$ transposition fabric. D_1 fabrics are difficult to recognize, but rootless isoclinal F_1 folds are

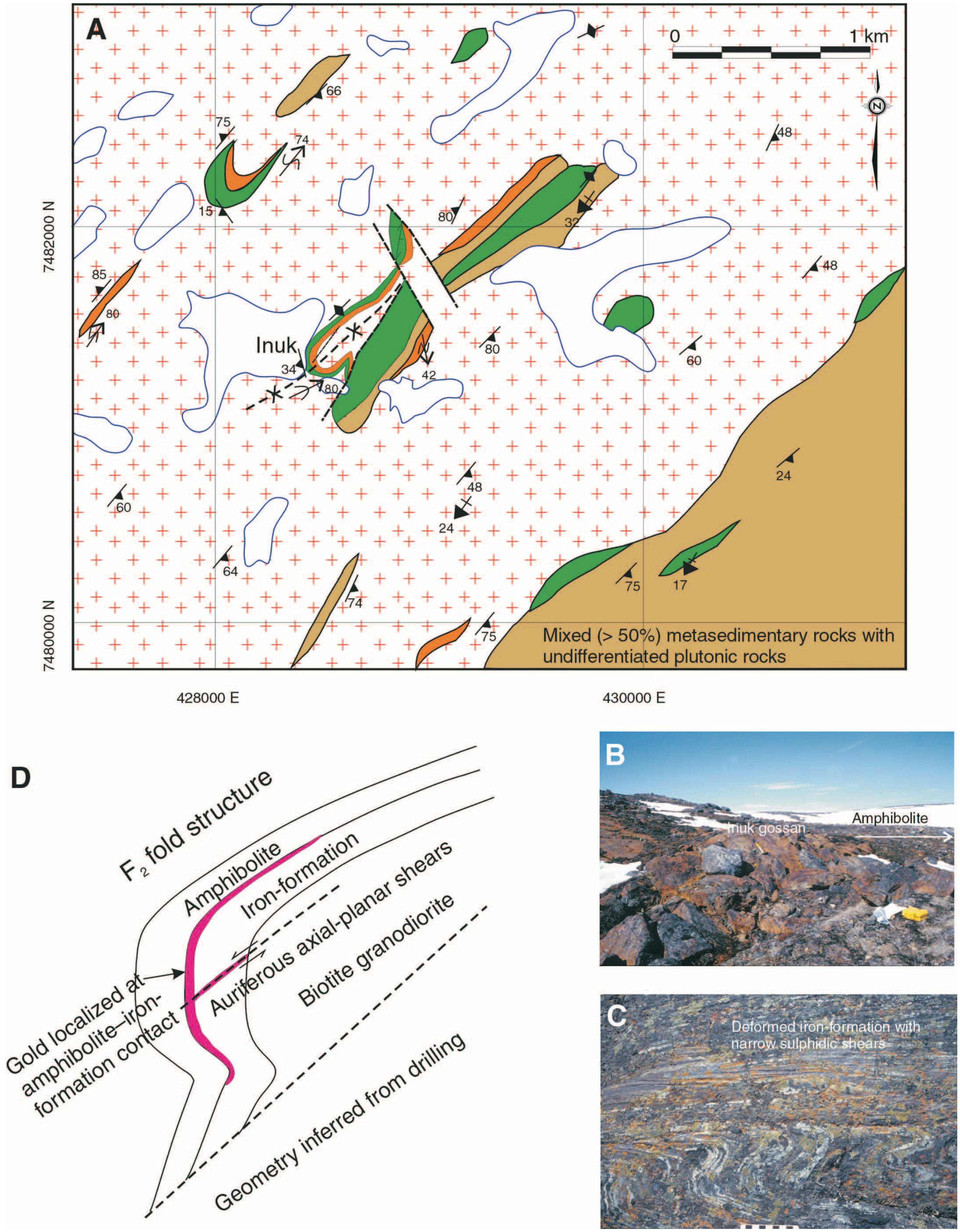

Figure 2. A. *Simplified geology of the Inuk area. Co-ordinates are UTM zone 16, in metres. See Figure 1D for legend.* ***B****. Photograph of gossanous iron-formation at Inuk, structurally underlying amphibolite.* ***C****. Deformed iron-formation, showing the development of discrete sulphidic shear zones axial-planar to the F_2 fold axis.* ***D****. Schematic diagram showing the general structural and stratigraphic framework of the Inuk showing and local controls on the distribution of gold mineralization.*

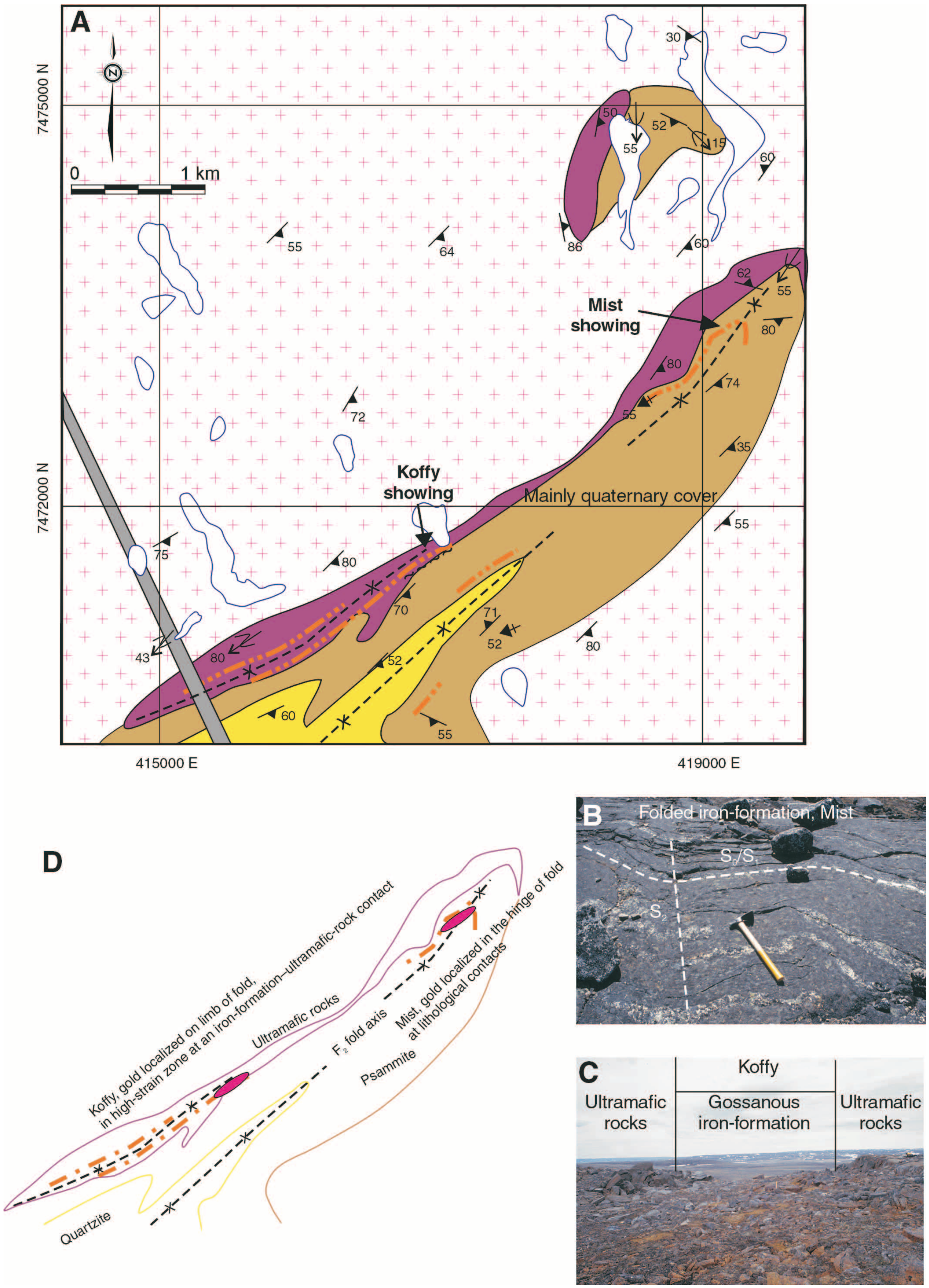

***Figure 3. A**. Simplified geology of the Mist-Koffy area. Co-ordinates are UTM zone 16, in metres. See Figure 1D for legend. **B**. Photograph of folded iron-formation at the Mist showing. These are open "M" folds in the hinge of an F_2 fold. **C**. Photograph of gossanous iron-formation interbedded with ultramafic rocks. **D**. Schematic diagram showing the general structural and stratigraphic framework of the Mist-Koffy area and local controls on the distribution of gold mineralization.*

evident locally in the iron-formation. At Koffy, D_2 geometry consists of a planar, straight, penetrative fabric, with strain concentrated in the iron-formation, particularly at lithological contacts with ultramafic rocks (Fig. 3D). At Mist, the dominant D_2 geometry is a large F_2 fold structure, with S_0/S_1 fabrics wrapping around the fold closure and $S_2 \pm S_1$ fabrics oriented axial-planar to the fold structure (Fig. 3B).

As at Inuk, the latest expression of D_2 deformation involved the development of high-strain zones localized in iron-formation intervals, mainly at the contact with ultramafic rocks (Koffy showing; Fig. 3D). Iron-formation units within these higher strain zones are sulphidized and silicified and locally contain auriferous, sulphidic white quartz veins, stringers of stretched and distorted ultramafic wallrock, and boudinaged dykes of monzogranite pegmatite. At Mist, D_2 structures are dominated by an F_2 fold and by axial-planar penetrative fabrics (Fig. 3D). Mist shows some similarities to Inuk, with gold localized at lithological contacts within dilational sites created by flexural slip along these contacts during folding.

Peanut showing

The Peanut showing is located along the southeast flank of Kinngalugjuaq Mountain, in the southwest corner of the Ellice Hills map area (Fig. 1C, 4A). Gold, in concentrations up to 9 g Au/t (Hurley and Williamson, 1995), is hosted in weakly sulphidic iron-formation within a relatively thick supracrustal package. Several other anomalous assays occur in the vicinity of the Peanut showing, at the south end of Kinngalugjuaq Mountain (mount Brisbin; Westerre Associates Ltd., unpub. report, 1970), and to the southeast of Peanut (Hurley and Williamson, 1995).

The supracrustal rocks in this part of the map area are dominated by a thick quartz-arenite interval that forms prominent topographic features (e.g. Kinngalugjuaq Mountain). Local primary sedimentary features have been recognized in the quartz arenite (Skulski et al., 2003), and accessory mineral phases include fuchsite, muscovite, sillimanite, and rare garnet. South of the quartz arenite, in the vicinity of Peanut, thin bands of ultramafic rocks and iron-formation are interbedded with a relatively thick sequence of clastic sediments (biotite-garnet semipelite to biotite psammite). The ultramafic rocks are typically thin (<20 m) units, with coloration banding alternating between red-brown and pale green, interpreted to represent cumulate-spinifex layering within komatiitic flows. These flows commonly contain discrete zones and/or bands of an amphibole-clinopyroxene-garnet assemblage that may reach up to 50 cm in thickness.

The iron-formation consists of centimetre-scale alternating layers of magnetite and quartz, interbedded with roughly equal amounts of garnet- and amphibole-rich zones (Fig. 4B). Several strands of iron-formation are recognized in the Peanut area; these strands may represent structural repetitions, or alternatively they may be discrete stratigraphic units. Rare sulphides (pyrite-pyrrhotite) occur locally. To the north of the Peanut showing, thin, grey-white, sulphidic quartz veins occur in the iron-formation and at the contact between iron-formation and ultramafic rocks. These veins are variably boudinaged and deformed by D_2 structures (Fig. 4C). The supracrustal package is intruded to the south by a moderately foliated, biotite±hornblende, potassium-phyric monzogranite (plutonic rocks are undifferentiated for clarity in Fig. 4A).

The main fabric observed in this segment of the Committee Bay Belt is a strong northeast- to southwest-striking foliation. D_1 structures are observed as isoclinal, nearly vertical folds in iron-formation, distorted and refolded by D_2 ($\pm$ D_3) structures. The fold asymmetries, and variable orientations of minor folds, suggest a complex deformational history. The two strands of ultramafic rocks that can be traced along the edge of Kinngalugjuaq Mountain (Fig. 4D) likely define separate limbs of an F_2 fold, or alternatively may be different stratigraphic units within the supracrustal package. D_3 is well developed in this part of the Committee Bay belt, with open warps of D_2 structures (Fig. 4D), and box-fold patterns are present (e.g. Curtis River fold structure; Skulski et al., 2003).

Gold at Peanut is hosted in sulphidic iron-formation, interbedded with ultramafic volcanic rocks and clastic sedimentary rocks. Mineralization is concentrated in high-strain zones developed at lithological contacts, likely along the limbs of an F_2 fold. During folding, differential movement by flexural slip along lithological contacts localized strain and dilation. The gold is associated with minor sulphides (pyrite and pyrrhotite) that are locally disseminated through magnetite- to amphibole-rich layers within the iron-formation. The relationship between quartz veins and gold mineralization has yet to be established.

DISCUSSION AND SUMMARY

The nature and timing of gold mineralization in iron-formation in the Ellice Hills area can be related to regional deformation events. Within the three areas described here, gold mineralization is localized in structural and stratigraphic settings where progressive D_2 deformation has resulted in a dilation. These settings permitted synkinematic fluid flow, alteration, and gold introduction mainly associated with sulphidation of iron-formation.

The three gold showings in the Ellice Hills map area have many similarities with iron-formation–hosted gold occurrences at the Three Bluffs, Hayes, and Antler showings in the Hayes River area. In this area, gold is associated with deformed sulphidic blue-grey quartz veins (Hyde et al., 2002). On the basis of textural relationships between these veins and D_2 fabrics, and of the presence of cordierite (as a metamorphosed alteration product), it has been suggested that mineralization occurred pre- or early-D_2, interpreted as early in a progressive D_2 event (Hyde et al., 2002). Similar quartz veins are absent at Inuk and Mist-Koffy, although silicification and sulphidation of iron-formation are related to localized dilation during D_2 deformation. Sulphidic quartz veins (locally deformed and boudinaged) occur in the Peanut area, but their relationship to gold mineralization is unclear.

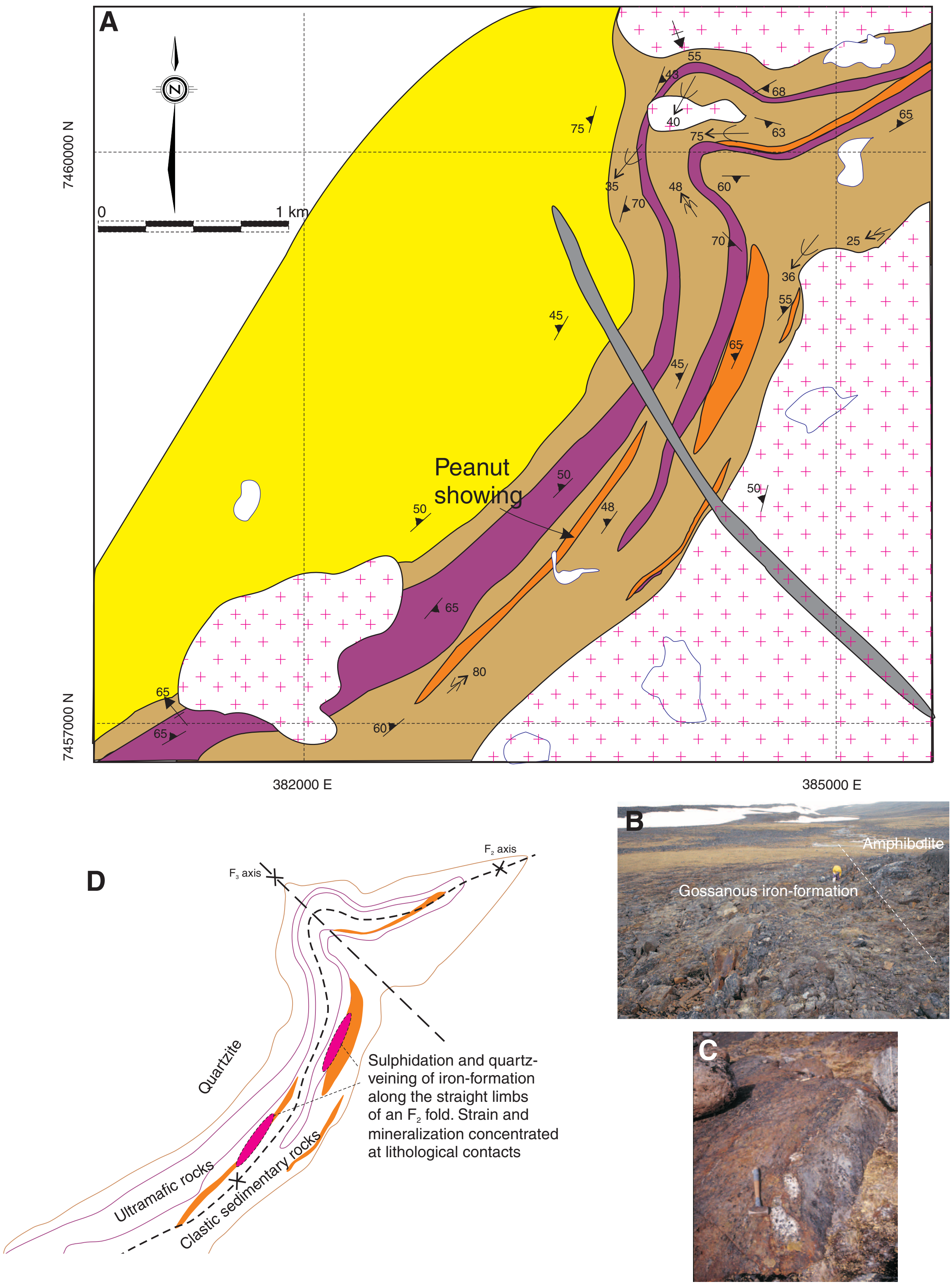

Figure 4. A. *Simplified geology of the Peanut area. Co-ordinates are UTM zone 16, in metres. See Figure 1D for legend.* ***B.*** *Photograph of gossanous iron-formation at Peanut, interlayered with amphibolite.* ***C***. *Boudinaged and deformed white quartz veins at the contact between iron-formation and ultramafic rocks near Peanut.* ***D.*** *Schematic diagram showing the general structural and stratigraphic framework of the Peanut showing and local controls on the distribution of gold mineralization.*

The Meadowbank deposit in the Woodburn Lake group (possibly correlative with the Prince Albert group; Fig. 1B) also shows many broad similarities with gold occurrences in the Ellice Hills and Hayes River areas. Meadowbank deposits are hosted in sulphidized iron-formation, and gold is associated with pyrrhotite-pyrite that preferentially replaces magnetite (Armitage et al., 1996; Sherlock et al., 2001a, b). The iron-formation units at Meadowbank mainly contain quartz, grunerite, and magnetite, in contrast to the Committee Bay area, where the mineral assemblage is mainly quartz, biotite, hornblende, garnet, and magnetite. Gold and sulphide introduction at Meadowbank is thought to be related to a progressive D_2 event similar to what we envisage for the Committee Bay belt. The bulk of the mineralization is concentrated at the lithological contact between an iron-formation and an ultramafic body. Partitioning of strain at this lithological contact resulted in localized dilation and synkinematic fluid flow, sulphidation of the iron-formation, and gold mineralization (Sherlock et al., 2001a, b).

A number of similarities exist between iron-formation–hosted gold deposits in the Woodburn Lake group and in the Prince Albert group. The overall mineralogy and style of the deposits are similar, with iron sulphides replacing magnetite in oxide-facies iron-formation. The metamorphic grade is higher to the northeast, ranging from middle greenschist facies in the Woodburn Lake group to upper amphibolite facies in the northeastern portion of the Prince Albert group; this variation in metamorphic grade has resulted in marked differences in the silicate mineralogy (McCuaig and Kerrich, 1998). The differences in metamorphic grade are also related to the style of deformation, with brittle-ductile deformation in the Woodburn Lake group and dominantly ductile deformation in the Prince Albert group. In the upper Hayes River area, gold is interpreted to have been introduced early in a progressive D_2 event, whereas in the Meadowbank area and Ellice Hills occurrences, gold is thought to have been introduced late in the progressive D_2 event. Critical to the localization of these deposits is the development of a structural setting in which strain is partitioned into the reactive iron-formation, resulting in localized dilation and synkinematic fluid flow, sulphidation of the iron-formation, and introduction of gold.

Although direct dating of the gold deposits in the Prince Albert and Woodburn Lake groups has not been undertaken, the absolute timing of gold mineralization can be inferred from dating of the regional D_2 events. In the Woodburn Lake group, preliminary interpretation of monazite chemical ages and of geological relationships suggests ca. 1.85 Ga metamorphism and D_2 deformation (Berman et al., 2002), loosely constraining the mineralization to the Paleoproterozoic. Similar ages for a D_2 event (ca. 1.86–1.82 Ga; Carson et al., 2002; Sanborn-Barrie et al., 2002a, b) were obtained for the Prince Albert group. These ages and geological relationships collectively suggest that a Paleoproterozoic (ca. 1.86–1.82 Ga) deformation event was responsible for the introduction of gold into these older Archean supracrustal sequences. This is consistent with geochronological results from hydrothermal-alteration products at Meadowbank (K-Ar, 1791±32 Ma; Armitage et al., 1996) and in the Meliadine area (Ar-Ar, 1780±20 Ma; Miller et al., 1995). These results do not preclude an older stage of Archean gold mineralization; however, they collectively support a younger, widespread gold-metallogenic event throughout portions of the western Churchill Province that were affected by Paleoproterozoic reworking.

ACKNOWLEDGMENTS

This project is part of the multidisciplinary Committee Bay Targeted Geoscience Initiative. It was made possible by funding from the Canada-Nunavut Geoscience Office and the Geological Survey of Canada. Ideas presented here have been influenced by the numerous geologists associated with this project over the last three years. This manuscript has benefited from a critical review by Hamish Sandeman.

REFERENCES

Armitage, A.E., James, R.S., and Goff, S.P.
1996: Gold mineralization in Archean banded iron formation, Third Portage Lake area, Northwest Territories, Canada; Exploration and Mining Geology, v. 5, p. 1–15.

Berman, R., Pehrsson, S., Davis, W.J., Snyder, D.B., and Tella, S.
2002: A new model for ca. 1.9 Ga tectonometamorphism in the western Churchill Province; linked upper crustal thickening and lower crustal exhumation; Geological Association of Canada – Mineralogical Association of Canada Annual Meeting, v. 27, p. 9.

Carson, C.J., Berman, R.G., Skulski, T., Sandeman, H.A.I., Sanborn-Barrie, M., and Stern, R.A.
2002: U-Pb geochronology of the Committee Bay belt: implications for the tectonothermal history of the Rae Domain; Yellowknife Geoscience Forum, Program with Abstracts. (CD-ROM)

Freeman, M.E. and Wyllie, W.J.
2002: Qualifying report on gold exploration (1992 to 2001), Committee Bay greenstone belt Laughlin Lake-Ellice Hills area Nunavut, Canada; report prepared for Committee Bay Resources Ltd. Public document filed with The Canadian Securities Administrators (CSA) and the Canadian Depository for Securities (CDS) System for Electronic Document Analysis and Retrieval (SEDAR; www.sedar.com).

Hurley, T.D. and Williamson, J.
1995: Committee Bay Project 1995 exploration report on the Laughland Lake – Curtis River Area, District of Keewatin, N.W.T. (NTS 56 J, K, O, P); Cyprus Canada Inc. Assessment Report submitted to Indian and Northern Affairs Canada.

Hyde, D.J., Jenner, G.A., and Sherlock, R.L.
2002: Auriferous iron-formation in the upper Hayes River area, central mainland, Nunavut; Geological Survey of Canada, Current Research 2002-E7, 9 p.

McCuaig, T.C. and Kerrich, R.
1998: P-T-t-deformation-fluid characteristics of lode gold deposits: evidence from alteration systematics; Ore Geology Reviews, v. 12, p. 381–453.

Miller, A.R., Balog, M.J., and Tella, S.
1995: Oxide iron-formation hosted gold, Meliadine Trend, Rankin Inlet Group, Churchill Province, Northwest Territories; *in* Current Research 1995-C; Geological Survey of Canada, p. 163–174.

Sanborn-Barrie, M., Skulski, T., Sandeman, H., Berman, R., Johnstone, S., MacHattie, T., and Hyde, D.
2002a: Structural and metamorphic geology of the Walker Lake–Arrowsmith River area, Committee Bay belt, Nunavut; Geological Survey of Canada, Current Research 2002-C12, 13 p.

Sanborn-Barrie, M., Sherlock, R., Skulski, T., Sandeman, H., Deyell, C., Johnstone, S., MacHattie, T., Brown, J., and Young, M.
2002b: Structural geology of the Committee Bay area and implications for gold localization, western Churchill Province, Nunavut; Yellowknife Geoscience Forum, Program with Abstracts. (CD-ROM)

Sanborn-Barrie, M., Sandeman, H., Skulski, T., Brown, J., Young, M., MacHattie, T., Deyell, C., Carson, C., Panagapko, D., and Byrne, D.
2003: Structural geology of the northeastern Committee Bay belt, Ellice Hills area, central Nunavut; Geological Survey of Canada, Current Research 2003-C23.

Sandeman, H.A., Brown, J., Studnicki-Gizbert, C., MacHattie, T., Hyde, D., Johnstone, S., Greiner, E., and Plaza, D.
2001a: Bedrock mapping in the Committee Bay Belt, Laughland Lake area, central mainland, Nunavut; Geological Survey of Canada, Current Research 2001-C12, 10 p.

Sandeman, H.A., Studnicki-Gizbert, C., Brown, J., and Johnstone, S.
2001b: Regional structural and metamorphic geology of the Committee Bay Belt, Laughland Lake area, central mainland, Nunavut; Geological Survey of Canada, Current Research 2001-C13, 11 p.

Sherlock, R.L., Alexander, R.B., March, R., and Kellner, J.
2001a: Geology of the Meadowbank iron formation-hosted gold deposits; Geological Survey of Canada, Open File 3149, 1 sheet, scale 1:7500.

Sherlock, R.L., Alexander, R.B., March, R., Kellner, J., and Barclay, W.A.
2001b: Geological setting of the Meadowbank iron-formation-hosted gold deposits, Nunavut; Geological Survey of Canada, Current Research 2001-C11, 10 p.

Sherlock, R.L. and Deyell, C.
2002: Geochemical and assessment report compilation for the Committee Bay region, central mainland, Nunavut (NTS 56K/J/O); Geological Survey of Canada, Open File 4257. (CD-ROM)

Skulski, T., Sandeman, H., Sanborn-Barrie, M., MacHattie, T., Hyde, D., Johnstone, S., Panagapko, D., and Byrne, D.
2002: Contrasting crustal domains in the Committee Bay belt, Walker Lake-Arrowsmith River area, central Nunavut; Geological Survey of Canada, Current Research 2002-C11, 11 p.

Skulski, T., Sandeman, H., Sanborn-Barrie, M., MacHattie, T., Young, M., Carson, C., Berman, R., Brown, J., Rayner, N., Panagapko, D., Byrne, D., and Deyell, C.
2003: Bedrock geology of the Ellice Hills map area and new constraints on the regional geology of the Committee Bay area, Nunavut; Geological Survey of Canada, Current Research 2003-C22.

Geological Survey of Canada Project 000028