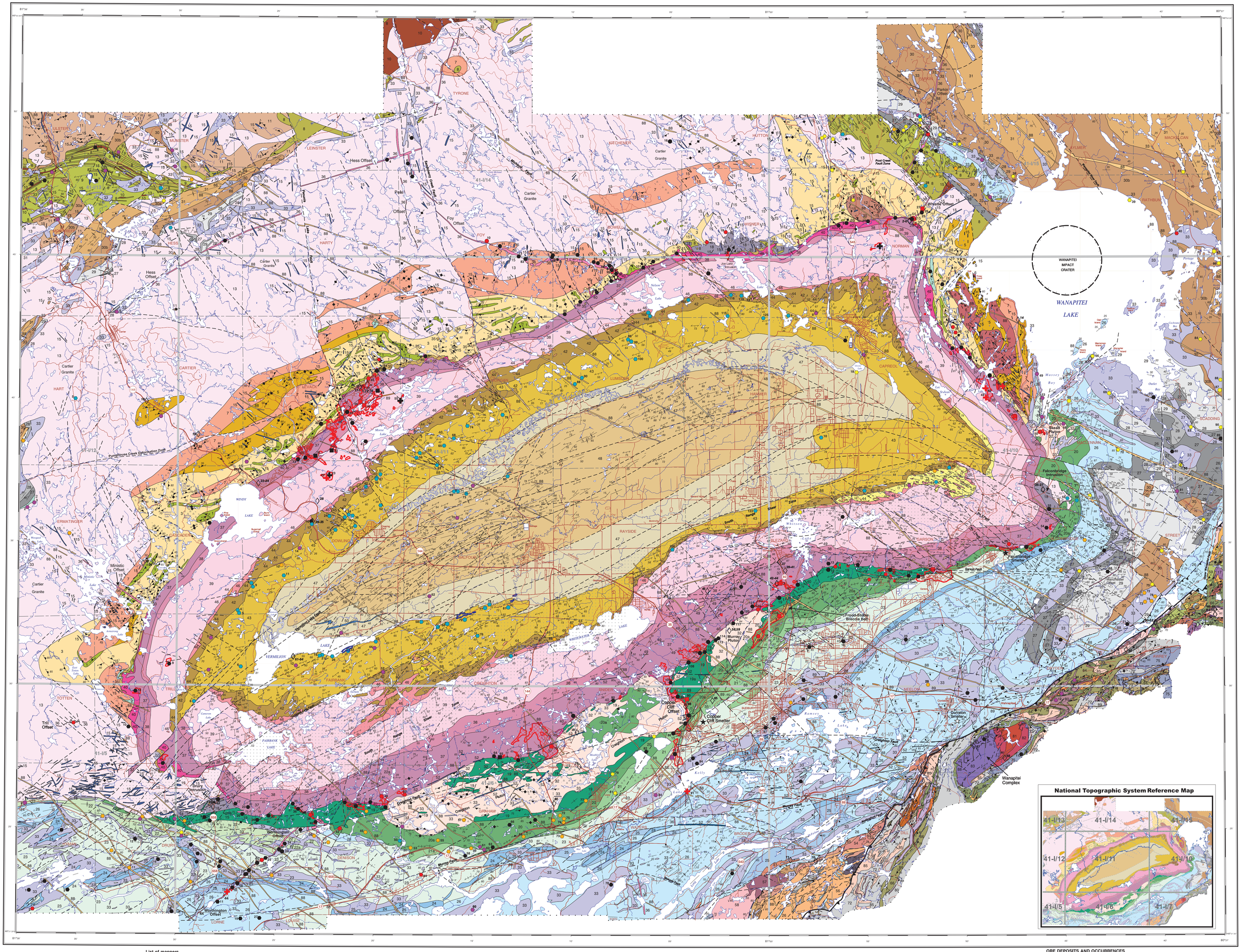

List of mappers

Northern footwall: Levack Gneiss Complex:	Ken Card, Wallbridge Inc. geologists
Onaping Formation:	Doreen Ames, Harold Gibson, Stuart Gibbins
South and East Range structure:	William Shanks, Jun Cowan
Offset dikes:	Peter Lightfoot, Alain Murphy, John Spray, Martin Tuchscherer, Christina Wood, Wallbridge Inc. geologists
Sudbury Igneous Complex:	William Shanks, Glen Johns, Alan Galley, Doreen Ames, Edward Pattison
Shattercones:	Paul Golightly
Grenville front:	Anthony Davidson, Michael Easton

Geologic mapping was conducted mostly in the 1990s

ORE DEPOSITS AND OCCURRENCES

Mines and occurrences are displayed according to status, colored by commodity and numbered within an NTS sheet. See NTS Reference map (above) for NTS sheet locations linked with Table 1 (see journal paper).

Status
- Advanced prospect
- Producer
- Past producer
- Occurrence

Commodity
- Ni-Cu
- Ni-Cu-PGE
- Zn-Pb-Cu
- Au
- Cu
- Other

Mineralization, orebodies
Surface projection of:
- Ni-Cu-PGE
- Zn-Pb-Cu

Sudbury Smelters (Copper Cliff, Falconbridge, and Coniston)
- Smelter: active, inactive

MAP 1. Geologic map of the Sudbury mining camp and surrounding area, Ontario, Canada.

LEGEND

PHANEROZOIC
EOCENE

WANAPITEI IMPACT CRATER (~37 Ma, Bottomley, 1982; Winzer et al., 1976) (4.5 km diameter; L'Heureux, 2003).

SUPERIOR, SOUTHERN, AND GRENVILLE PROVINCES

PRECAMBRIAN
NEOPROTEROZOIC

89 *Diabase - Grenville dike swarm (590 +2/-1 Ma; Kamo et al., 1995).*

MESOPROTEROZOIC (1600–1000 Ma)

88 *Olivine diabase - Sudbury dike swarm (1238 ± 4 Ma; Krogh et al., 1987; 1235 +7/-3 Ma; Dudás et al., 1994).*

GRENVILLE PROVINCE

MESOPROTEROZOIC

87 *Cataclasite and fault gouge associated with the Grenville Front.*

86 *Deformed pegmatite (ca. 1150 Ma, Krogh, 1994).*

MESOPROTEROZOIC or PALEOPROTEROZOIC

85 *Migmatitic granite orthogneiss (age unknown).*

84 *Undivided granodiorite, diorite, and gabbro orthogneiss; locally garnet-bearing and migmatitic (age unknown).*

PALEOPROTEROZOIC (affected by Grenville)

WANAPITEI MAFIC IGNEOUS COMPLEX

83 *Flow-foliated igneous breccia, agmatite, commingled gabbroic and granitic rocks.*

82 *Hornblende gabbro, gabbronorite, layered in part (1747 +6/-5 Ma, Prevec, 1992, metamorphic age?).*

81 *Coronitic olivine melagabbro.*

80 *Black amphibolite, hornblende-plagioclase gneiss; derived from gabbro. Age unknown; possibly derived from Nipissing gabbro (unit 33).*

79 *Dark green amphibolite with acicular amphibole (age unknown).*

GRANITE GNEISS (2446 ± 7 Ma, Davidson and van Breemen, Geological Survey of Canada unpubl.; 2475+25/-10 Ma, Corfu and Easton, 2000).

78 *Migmatitic granitoid orthogneiss.*

EAST BULL LAKE IGNEOUS SUITE (2490 to 2470 Ma)

77 *Granitoid migmatite at contact of metagabbroic anorthosite (unit 75).*

76 *Migmatitic granitic orthogneiss.*

75 *Metagabbro anorthosite and derived gneiss, commonly with mafic seams.*

74 *Metagabbro, hornblende gneiss.*

73 *Meta-ultramafic rock: amphibolite with orthopyroxene megacrysts, locally carrying relict olivine; occurs as isolated pods or boudins (2468 ± 5 Ma, Corfu and Easton, 2000).*

SUPRACRUSTAL ROCKS (age unknown), possibly in part derived from Huronian Supergroup (units 19–31)

72 *Undivided metasupracrustal rocks; mainly migmatitic biotite- and hornblende-garnet gneiss, with minor calc-silicate, metaconglomerate and intercalated amphibolite in the northeast; predominantly biotite-garnet gneiss and psammite with intercalated quartzofeldspathic gneiss in the southwest.*

71 *Mainly metaconglomerate and derived gneiss and schist; minor layers of garnet-biotite gneiss.*

70 *Calc-silicate gneiss, minor marble.*

69 *Mainly kyanite-rich garnet-muscovite-biotite-quartz-plagioclase schist and gneiss; locally separated from adjacent unit 64 by a narrow layer of quartzite.*

68 *Relatively massive biotite and biotite-garnet paragneiss and migmatite, in part derived from polymictic conglomerate.*

67 *Quartzofeldspathic schist, rusty in part, derived from sandstone, intercalated toward the southeast with biotite-garnet paragneiss and metaconglomerate with sparse, highly flattened pebbles.*

66 *Mainly well-layered biotite-garnet gneiss, migmatitic in part, and intercalated locally with kyanite-garnet-biotite-muscovite schist.*

65 *Layered, light gray, muscovite-bearing quartzofeldspathic gneiss derived from feldspathic sandstone.*

64 *Mainly garnet-hornblende-quartz-plagioclase gneiss and migmatite; may contain calc-silicate layers, and grade to hornblende-rich gneiss.*

NEOARCHEAN (rocks present only in Grenville Province)

63 *Intermediate to felsic plutonic rocks; biotite granodiorite to diorite.*

Migmatitic to metataxitic gneisses (5–20% leucosome)

62 *Mafic gneiss (possibly intrusive); podiform amphibolite to garnet-amphibolite.*

61 *Felsic to aluminous gneiss.*

60 *Biotite-garnet gneiss.*

59 *Mafic gneiss (possibly metavolcanic); migmatitic amphibolite, may contain garnet, gedrite, cummingtonite.*

SOUTHERN PROVINCE

MESOPROTEROZOIC

CHIEF LAKE IGNEOUS COMPLEX

58 *Pine Lake unit; massive, uniform, pink, fine- to medium-grained biotite leucogranite.*

57 *Fern Lake unit; massive, gray hornblende diorite, commonly with hornblende-rich xenoliths; commingled with fine-grained granite in western part; includes numerous rafts of Lorrain Formation quartzite (unit 31).*

56 *Linton Lake unit; pink to gray, foliated to mylonitic, biotite granite to granodiorite with feldspar augen.*

55 *Raft Lake unit; medium- to coarse-grained, massive to foliated, pink, megacrystic granite (1464 +2/-1 Ma; Davidson and van Breemen, 1994).*

54 *Raft Lake unit; gabbro, diorite, in part commingled with megacrystic granite.*

53 *Hornblende gabbro.*

MESO to PALEOPROTEROZOIC

52 *Quartz diabase, commonly altered ('Trap dikes' North Channel swarm of Fahrig and West, 1986).*

PALEOPROTEROZOIC

EDEN LAKE SUITE (1747 ± 3 Ma, Sullivan and Davidson, 1993; 1749 +7/-8 Ma, Davidson and van Breemen, 1994)

51 *Biotite granodiorite.*

50 *Carbonatized gabbroic rocks (Sudbury basin).*

49 *Remobilized granitic rocks, aplite largely derived from 2477 Ma felsic plutons (unit 32) (1848 ± 4 Ma; Galley, Ames, and van Breemen, unpubl.).*

WHITEWATER GROUP

48 *Chelmsford Formation: turbiditic wacke and siltstone.*

47 *Onwatin Formation: carbonaceous and pyritic argillite, siltstone and minor wacke.*

Syn-Onaping intrusive rocks

46 *Onaping intrusions; xenolithic quartz diorite with abundant partially assimilated Archean and Proterozoic fragments.*

45 *Aphanitic andesite dikes and sills, commonly flow-banded, spherulitic, xenolithic.*

44 *Undivided, previously mapped as melt bodies (Dressler, 1984); may be unit 42 fluidal fragment units, unit 45 and/or unit 46*

Onaping Formation

43 *Dowling Member: fragmental rocks composed of <30% altered lenticular vitric andesite fragments and >50% matrix; composed of contact, lower, and iridium-bearing (Mungall et al., 2004) middle and upper units, dominantly tuff with minor lapilli-tuff, middle and upper units block and bomb-poor, chlorite-calcite alteration, may contain carbon.*

Erosive contact

42 *Sandcherry Member: fragmental rocks composed of >60% altered blocky vitric andesite fragments, <35% matrix, block and bomb-rich; composed of fluidal fragment units and equant shard units, dominantly lapilli-tuff to lapillistone; in part silicified and/or albitized (1848 +3.9/-1.8 Ma; Ames et al., 1998), may contain carbon.*

41 *Garson Member (South Range only): thick-bedded to massive fragmental rocks dominated by >20 to 85% Huronian quartzite fragments (< 6 cm) and blocks (> 6 cm to 50 m), and containing up to 15% vitric andesite lapilli, and <5% vitric andesite bombs and blocks. Lapillistone and coarse tuff breccia units are most common, the latter with a lapillistone to lapilli tuff matrix. Depositional units are typically massive to reversely graded.*

SUDBURY IGNEOUS COMPLEX (1850 ± 1 Ma; Krogh et al., 1984)

40 *Contact Sublayer; inclusion and sulfide-bearing gabbronoritic to noritic rock.*

39 *Upper zone; granite, granodiorite, 'granophyre and plagioclase-rich granophyre'.*

38 *Middle zone; quartz monzogabbro, 'quartz gabbro'.*

37 *Lower zone; quartz monzogabbro and quartz gabbro, North Range: 'felsic norite' and 'mafic norite'; South Range: 'norite and quartz-rich norite'.*

36 *Offset dikes; 'quartz diorite' and breccia, granodiorite, quartz monzodiorite, quartz diorite; marginal inclusion/sulfide-free phase, central sulfide/inclusion-rich phase.*

35 *FOOTWALL BRECCIA. Heterolithic breccia containing footwall rock fragments set in a contact metamorphic, granoblastic, in places granophyric matrix.*

SUDBURY BRECCIA. Randomly oriented blocks of country rock in fine-grained pseudotachylitic and/or cataclastic matrix.

33 *NIPISSING MAFIC INTRUSIVE SUITE (2210–2217 Ma; Corfu and Andrews, 1986; Noble and Lightfoot, 1992; Buchan et al., 1998). Noritic quartz gabbro and amphibolitic equivalents.*

32 *CREIGHTON (2415 ± 5 Ma, 2376 ± 2.3; Smith, 2002), MURRAY (2477 ± 9 Ma; Krogh et al., 1996) and SKEAD PLUTONS. Quartz monzonite, granite. Only known to intrude Elsie Mountain and Stobie Formations (units 19, 20); may be cogenetic with Copper Cliff Formation (unit 21).*

Intrusive contact

HURONIAN SUPERGROUP (<2480 to >2220 Ma)

COBALT GROUP

31 *Lorrain Formation; crossbedded, ripple and planar laminated arkose, subarkose, quartz arenite, a- minor quartz and jasper pebble conglomerate.*

30 *Gowganda Formation; a- polymict conglomerate, b- lith-arenite, lithic-wacke, massive and finely laminated siltstone and argillite, locally with dropstones.*

Local unconformity

QUIRKE LAKE GROUP

29 *Serpent Formation; crossbedded arkose, subarkose, local pebbly arkose and calcareous sandy mudstone.*

28 *Espanola Formation; limestone at base (Bruce Member), middle laminated calcareous siltstone, wacke, calcareous arkose and subarkose and local dolostone at top.*

27 *Bruce Formation; matrix-supported polymict conglomerate, minor wacke, arkose and siltstone.*

HOUGH LAKE GROUP

26 *Mississagi Formation; crossbedded subarkose and arkose, minor a- wacke, b- quartz-pebble conglomerate.*

25 *Pecors Formation; laminated to thin planar and wavy laminated wacke, mudstone, siltstone and arenite, knotted staurolite-andalusite schist.*

24 *Ramsey Lake Formation; matrix-supported polymict conglomerate, minor mudstone, wacke, arenite.*

ELLIOT LAKE GROUP (2470 to 2450 Ma)

23 *McKim Formation; laminated, thin- to thick-bedded wacke and siltstone.*

22 *Matinenda Formation; a- crossbedded arkose, b- wacke, c- uraniferous quartz-pebble conglomerate.*

21 *Copper Cliff Formation; (2450 +25/-10 Ma; Krogh et al., 1984 (coeval with Murray pluton); aphyric to quartz and quartz-feldspar porphyritic rhyolitic flows, domes and associated autoclastic breccias, subordinate felsic tuff and felsic quartz ± feldspar crystal lapilli tuffs, a- localized massive and pillowed basalt.*

20 *Stobie Formation; pillowed and massive basalt, mafic and intermediate pyroclastic rocks, wacke in the middle and upper parts; a- intercalated wacke, siltstone, and arenite, b- minor dacite and rhyolite.*

19 *Elsie Mountain Formation; pillowed and massive basalt, mafic and intermediate pyroclastic rocks, minor wacke a- intercalated wacke, siltstone, and arenite, commonly sulfidic, b- minor dacite and rhyolite.*

EAST BULL LAKE IGNEOUS SUITE (2490 to 2470 Ma; Krogh et al., 1984; Prevec, 1992)

18 *Gabbro, gabbro norite, and anorthositic equivalents.*

17 *Melanocratic gabbro, gabbro norite.*

16 *Ultramafic rocks.*

SUPERIOR PROVINCE

PALEOPROTEROZOIC

15 *Diabase - Matachewan dike swarm (2473 +16/-9 and 2446 ± 3 Ma, Heaman, 1997).*

14 *Glomeroporphyritic to porphyritic diabase (uncertain affinity).*

NEOARCHEAN

13 *Cartier batholith: massive granodiorite, granite (~2640 Ma).*

12 *Monzonite, monzodiorite (~2655 Ma).*

11 *Metatexite, diatexite, rocks similar to Levack gneiss complex units 5 and 6, but containing >30% granitic leucosome.*

Metavolcanic and metasedimentary rocks (Benny Belt)

10 *Metasediments; a- wacke, b- chert, IF- iron-formation.*

9 *Intermediate and felsic metavolcanic rocks; a- flows, b- pyroclastic rocks.*

8 *Mafic metavolcanic rocks; amphibolite and mafic schist, a- massive and pillowed flows, b- pyroclastic rocks.*

LEVACK GNEISS COMPLEX (~2700–2640 Ma)

7 *Early felsic plutonic rocks; foliated granodiorite, granite.*

6 *Heterogeneous diatexite (>30% mobilizate).*

5 *Paragneiss, in part migmatitic (<30% mobilizate).*

4 *Iron-formation.*

3 *Tonalite-granodiorite gneiss, xenolithic tonalite-granodiorite gneiss.*

2 *Mafic, ultramafic, and anorthositic intrusive rocks.*

1 *Mafic and ultramafic gneiss.*

Geologic boundary
Dip of lower contact of the Sudbury Igneous Complex 32
Limit of mapping
Fault or lineament
Thrust fault
Grenville Front boundary fault
Normal fault
Anticline
Antiform
Syncline
Synform
Bedding, top known (inclined, vertical, overturned) 45 30
Bedding, top unknown (inclined, vertical, horizontal) 45
Shear foliation (inclined, vertical) 45
Foliation (inclined, vertical) 45
Fold axial plane (inclined, vertical, unspecified)
Gneissosity (inclined, vertical) 45
Igneous layering (inclined) 35
Lineation (trend, plunge) 45
Shattercone (orientation unknown, orientation known - positive: up, negative: down) 35
U-Pb isotopic age (see Table 2) 17
South Range shear zone (1658 ± 68 Ma; Bailey et al., 2004)

Mean magnetic declination 2008, 10°17'W, decreasing 0.5' annually

GEOLOGIC MAP OF THE SUDBURY MINING CAMP AND SURROUNDING AREA, ONTARIO, CANADA

Authors: D.E. Ames, A. Davidson, and N. Wodicka

Geology by D.E. Ames, K. Card, and A. Davidson. Geochronology compilation by N. Wodicka and D.E. Ames. Mineralization outlines provided by FNX, INCO, and Falconbridge in 2005.

Supplement to Ames, D.E., Davidson, A., and Wodicka, N., 2008,
Geology of the giant Sudbury polymetallic mining camp, Ontario, Canada:
Economic Geology, v. 103, p. 1057–1077.