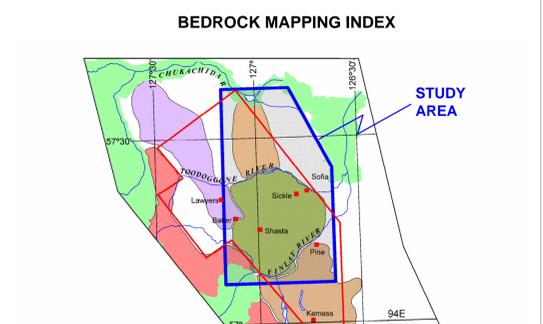


- EARLY JURASSIC HAZELTON GROUP**
- UPPER TODDOGGONE FORMATION**
- Belle member**
- TB** Rhyolite ignimbrite; locally very thick (150m minimum); welded columnar jointed exposures.
 - TPv2** Andesite porphyry lava flows containing minor chlorite-altered pyroxene, scarce laminated dacitic flows.
 - TPs2** Lapilli tuff, litho-crystal tuff and minor accretionary lapilli tuff; minor tuffaceous sandstone and conglomerate; well bedded.
 - TPv1** Basaltic andesite and andesite porphyry lava flows containing up to 3% subvolcanic clinopyroxene phenocrysts, rare limestone lenses near the base.
 - TPs1** Tuffaceous sandstone, siltstone and conglomerate; interlayered fine tufts, lapilli tufts and lesser tuff breccia, minor accretionary lapilli tuff; well bedded.
- Graves member**
- TG** Dacite ash-flow tuff; light green to maroon, texturally variable including nonwelded, locally lithic rich, and thick (100-150m) welded columnar jointed zones; diagnostic accidental pyroclasts include pink, quartz-biotite dacite porphyry and biotite-hornblende quartz tuff; cross-laminated ground surge tuff or layered fallout ash and fine lapilli tuff at the base.
 - TGr** Rhyolite flows and related monolithic flow breccias; maroon to reddish-brown, flow laminated, spherulitic crystallization widespread; thin fallout ash tuff locally at the base yields a U-Pb date of 192.0 ± 1.2 Ma.
 - TJv** Basalt and andesite lava flows characterized by crowded plagioclase 1mm long or less and relatively fresh pyroxene; minor pyroxene bearing sandstone interbeds.
 - TJr** Dacite to rhyolite lava flows; lenticular; commonly flow-laminated deposits.
 - TJs** Debris flow or volcanic conglomerate; subangular to rounded boulders of monolithic medium-grained andesite porphyry, reddish oxidized mucky matrix, interbeds of sandstone and siltstone; similar conglomeratic rocks west of the Pillar Fault are unconformable on UTS.
 - TJd** Conglomerate and sandstone dominated by fine grained basaltic detritus that is presumably derived in part from the UTS; UTS tuff, reworked polymict lapilli tufts and volcanic breccias, heterolithic unit comprising diffusely layered very thick beds.
- LOWER TODDOGGONE FORMATION**
- Tu** Unassigned; lapilli tuff, tuff breccia and lesser dacite lava flows containing trace amounts of quartz and titanite.
- Saunders member**
- TS** Dacite ash-flow tuff; grey-green, up to 55% crystal fragments of plagioclase, quartz, hornblende and biotite; diagnostic juvenile porphyritic vitriclasts; widespread moderate to strong welded fabric.
- Metasand member**
- TM** Andesite lava flows; grey-green to light purple, 15-25% plagioclase 2-5mm long; sparse chlorite-altered hornblende and pyroxene, trace amounts of biotite and rare quartz phenocrysts.
 - TMs** Feldspathic sandstone, minor mudstone.
- Duncan member**
- TD** Lapilli tufts with volcanoclastic-epilastic interbeds; greenish with oxidized reddish sections, pyroclasts commonly consist of reddish brown andesite porphyries mixed with plagioclase and up to 2% oxidized copper coloured biotite and quartz crystal fragments; interbeds of sandstone, siltstone and maroon mudstone.
 - Tc** Conglomerate locally at the base of the Toddoggone Formation; poorly sorted rounded clasts to boulder size dominated by crowded felsic porphyry; locally contains distinctive megacrystic basalt porphyry (unit UTd), limestone (unit PAI) and granitoid clasts; crudely layered thick beds interlayered with subordinate sandstone and siltstone.
- LATE TRIASSIC TAKLA GROUP**
- UTTh** Megacrystic basalt porphyry lava flows characterized by bladed plagioclase laths between 1 and 3 cm long.
 - UTTa** Sandstone and siltstone; drab olive green, dominated by plagioclase and lesser pyroxene grains; bedded section between lava flows of unit UTa; rare discontinuous grey-black laminated limestone up to 1.5 metres thick.
 - UTTI** Rare discontinuous grey-black laminated limestone up to 1.5 metres thick.
 - UTL** Basalt and andesite lava flows; typically fine to medium grained clinopyroxene-plagioclase porphyries and aphanitic lavas; typically unaltered to subvolcanic.
- LATE CARBONIFEROUS TO EARLY PERMIAN ASITKA GROUP**
- PAs** Grey chert interbedded with black siltstone and mudstone; gradationally overlies limestone at the top of the Asitka Group.
 - PAI** Limestone; off white, light grey weathering; recrystallized; contains poorly preserved rugose corals.
 - PAV** Dacitic lapilli tuff with aphanitic greyish-white felsic fragments, grey-green to dark purple, rare accretionary lapilli tuff, porphyritic sparse quartzitic andesite and dacite-rhyolite lava flows.
- EARLY JURASSIC BLACK LAKE INTRUSIVE SUITE STOCKS**
- BLqm** Quartz monzonite; pink, medium to coarse inequigranular subhedral plagioclase, potassium feldspar and 10-20% anhedral quartz, and variably chlorite-altered hornblende (10-15%) and biotite (3-5%).
 - BLm** Monzonite; orange to pink, coarse inequigranular to porphyritic texture, subhedral plagioclase enclosed by fine grained interstitial potassium feldspar and typically less than 5% quartz, anhedral chlorite hornblende and biotite.
 - BLg** Granite; pink, medium-grained equigranular texture.
 - BLd** Undifferentiated diorite, quartz diorite, monzonite and quartz monzonite; clinopyroxene bearing with subordinate to minor hornblende and trace biotite; biotite-rich variants occur locally.
- LATE TRIASSIC**
- LTqm** Hornblende-biotite granodiorite and quartz monzonite; oxidized red, medium to coarse inequigranular texture; widespread epidote-chlorite-sericite alteration; minor malachite within fractures.
- DIKES AND SILLS**
- Tr** Undifferentiated monzonite to quartz monzonite porphyry, quartz-feldspar porphyry dikes; typical orange-pink, oxidized plagioclase and groundmass, medium to coarse plagioclase and chlorite-altered hornblende and biotite. (Note: Other dike varieties that are locally numerous but too narrow to portray on this map include dark green, aphanitic to amygdaloidal basalt, and flow-margined rhyolite.)
 - Tb** Diorite or basalt sill or plug.
 - Tr** Dacite to rhyolite sills, locally flow laminated.
 - r** Quartz rhyolite porphyry; off white to pale green groundmass, conspicuous quartz phenocrysts as large as 1.5 cm in diameter (up to 20%).

- SYMBOLS**
- Limit of mapping: (dotted line)
 - Geological contact (defined, approximate, inferred, inferred from aeromagnetic): - - - - - (long-dashed line)
 - Unconformity (defined, inferred): - - - - - (short-dashed line)
 - Normal fault (ball on down-dropped side; defined, approximate, inferred): - - - - - (line with triangles)
 - Reverse fault (defined, approximate, inferred): - - - - - (line with inverted triangles)
 - Wrench fault (defined, approximate, inferred): - - - - - (line with perpendicular dashes)
 - Bedding: - - - - - (line with small dashes)
 - Welded fabric: - - - - - (line with small circles)
 - Flow lamination: - - - - - (line with small squares)
 - Representative stratigraphic section location (Locations keyed to inset diagram): ① (circle with number)
 - Field station: * (asterisk)
 - Isotopic age determination (in millions of years, Ma): 203.3 ± 0.5 (circle with number and error)
 - U-Pb (zirconization date): 203.3 ± 1.2 (circle with number and error)
 - Air/Ar (gas-argon) dating, hydrothermal date: 196.9 ± 2.1 (circle with number and error)
 - Unreliable date or date not obtained: (circle with slash)
 - Fossil site and GSC collection number (C-211439): (circle with number)
 - Macrofossil: (circle with 'f')
 - Palynofossil: (circle with 'p')
 - Coronoid: (circle with 'c')
 - Barren or indeterminate fossil collection: (circle with 'x')
 - Regional Geochronology Survey site (RGS): (circle with 'R')
 - MNLE occurrence and reference number: (circle with 'M')
 - Quartz veining (pyrite + chalcopyrite, galena, pyrrhotite): (circle with 'Q')
 - Malachite with or without chalcopyrite: (circle with 'M')
 - Skarn (dopside-garnet-magnetite + chalcopyrite + pyrrhotite): (circle with 'S')
 - Gossan: (circle with 'G')
 - Flooded land: (circle with 'F')
 - Top: (circle with 'T')
 - Landslide scarp: (circle with 'L')
 - Road (all weather, seasonal): (circle with 'R')



- BEDROCK MAPPING**
- Diakow, 2005
 - Diakow et al., 2005, 2004
 - Diakow et al., 2001
 - Diakow et al., 1993
 - Eisbacher, 1974
 - Shives et al., 2004
 - Provincial Park
- AIRBORNE MAGNETIC-RADIOMETRIC SURVEY**
- Shives et al., 2004
- References**
- Diakow, L.J. (2005). Geology between the Finlay River and Chukachida Lake, Central Toddoggone River Map Area, North-central British Columbia (Parts of NTS 94E/2, 6, 7, 10 and 11). B.C. Ministry of Energy, Mines and Petroleum Resources, Open File Map 2005-6, 1:50 000 scale.
- Diakow, L.J., Nixon, G.T., Rhodes, R., and van Bui, P. (2005). Geology between the Finlay and Toddoggone Rivers, Toddoggone River Map Area, North-central British Columbia (Parts of NTS 94E/2, 6, 7, 10 and 11). B.C. Ministry of Energy, Mines and Petroleum Resources, Open File Map 2005-6, 1:50 000 scale.
- Diakow, L.J. (2004). Geology of the Samuel Black Range between the Finlay River and the Toddoggone River, Toddoggone River Map Area, North-central British Columbia (Parts of NTS 94E/2, 6, 7, 10 and 11). B.C. Ministry of Energy, Mines and Petroleum Resources, Open File Map 2004-4, 1:50 000 scale.
- Diakow, L.J. (2001). Geology of the Southern Toddoggone River and Northern McConnel Creek Map Areas, North-central British Columbia (Parts of NTS 94E/2, 94D/15 and 16). B.C. Ministry of Energy, Mines and Petroleum Resources, Geoscience Map 2001-1, 1:50 000 scale.
- Diakow, L.J., Parvaley, A., and Schuster, T.G. (1993). Geology of the Early Jurassic Toddoggone Formation and Gold-Silver Deposits in the Toddoggone River Map Area, Northern British Columbia. B.C. Ministry of Energy, Mines and Petroleum Resources, Bulletin 86, 72 pages with maps at 1:100 000 scale.
- Eisbacher, G.H. (1974). Sedimentary History and Tectonic Evolution of the Basin and Range Province, North-central British Columbia. Geological Survey of Canada, Open File 483.
- Gabris, H., Dods, C.J., Marry, J.L., and Eisbacher, G.H. (1977). Geology of Toddoggone River (4E) and Ware West Half (9E). Geological Survey of Canada, Open File 483.
- Shives, R.K., Carson, J.M., Dumont, A., Ford, K.L., Helman, P.B., and Diakow, L. (2004). Helicopter-borne Gamma-Ray Spectrometry and Magnetic Total Field Geophysical Survey (Parts of NTS 94D/15, 94E/2, 6, 7, 10, 11). Geological Survey of Canada, Open File 4814.

- Supplementary Datasets**
- Jackman, W. (1997). British Columbia Regional Geochronology Survey NTS 94E-Toddoggone River, Stream Sediment and Water Geochronological Data. B.C. Ministry of Employment and Investment, BC RGS-86.
- Jackman, W. (1997). British Columbia Regional Geochronology Survey NTS 94D-McConnel Creek, Stream Sediment and Water Geochronological Data. B.C. Ministry of Employment and Investment, BC RGS-86.
- (1999). Aeromagnetic Residual Total Field Survey of Toddoggone River (NTS 94E) and Ware (NTS 94F). Geological Survey of Canada, Open File 3495, 8 sheets at 1:100 000 scale.
- Map Base Information**
- 1:50 000 scale map base produced from TRIM 1:20 000 scale topographic database supplied by LandData B.C. North American Datum (NAD) 83, Latitudinal/Longitudinal Projection, UTM Zone 9. Approximate mean magnetic declination (2004) between magnetic north and grid north is 23°4' east, decreasing about 17' annually. Elevations in metres above sea level.
- Preface**
- This geological map is the result of a 1:20 000-scale bedrock mapping program conducted from 2003 to 2005 as part of a partnership between the B.C. Geological Survey and Sable Minerals Ltd., Northgate Exploration Ltd., Finlay Minerals Ltd., Bishop Resources Inc., Sable Resources Ltd., the Geological Survey of Canada, and the University of British Columbia. This map covers approximately 900 km² of mountainous terrain between the Finlay River and Chukachida Lake, expanding detailed 1:20 000-scale mapping to the north beyond published BCOS Geoscience Map 2001-1, centred on the Keness South Au-Cu porphyry mine. It portrays updated and revised stratigraphy for the Early Jurassic Toddoggone Formation and conglomeratic plutons of the Black Lake intrusive suite. The Toddoggone Formation in the map area is largely composed of a previously unrecognized stratigraphic succession that is subdivided into 4 new units (i.e. Belle, Pillar, Graves and Junkers). These units consist mainly of subvolcanic basalt to rhyolite volcanic rocks and derived sedimentary rocks that were deposited between 194Ma and 196Ma. They overlie previously defined, pre-194 to 200Ma Toddoggone Formation, and older Late Triassic basement above an erosional unconformity.
- Regionally the Toddoggone Formation is noted for numerous epithermal precious metal occurrences and quartz monzonite to monzonite plutons of the Black Lake intrusive suite locally host Au-Cu porphyry mineralization. Copper-magnetite skarns are locally developed within Early Permian intrusives of the Asitka Group cross-cut by Early Jurassic plutons.

- Recommended Citation:**
- Diakow, L.J., Nixon, G.T., Rhodes, R., and van Bui, P. (2006). Geology of the Central Toddoggone River Map Area, North-central British Columbia (Parts of NTS 94E/2, 6, 7, 10 and 11). B.C. Ministry of Energy, Mines and Petroleum Resources, Geoscience Map 2006-6, 1:50 000 scale.

