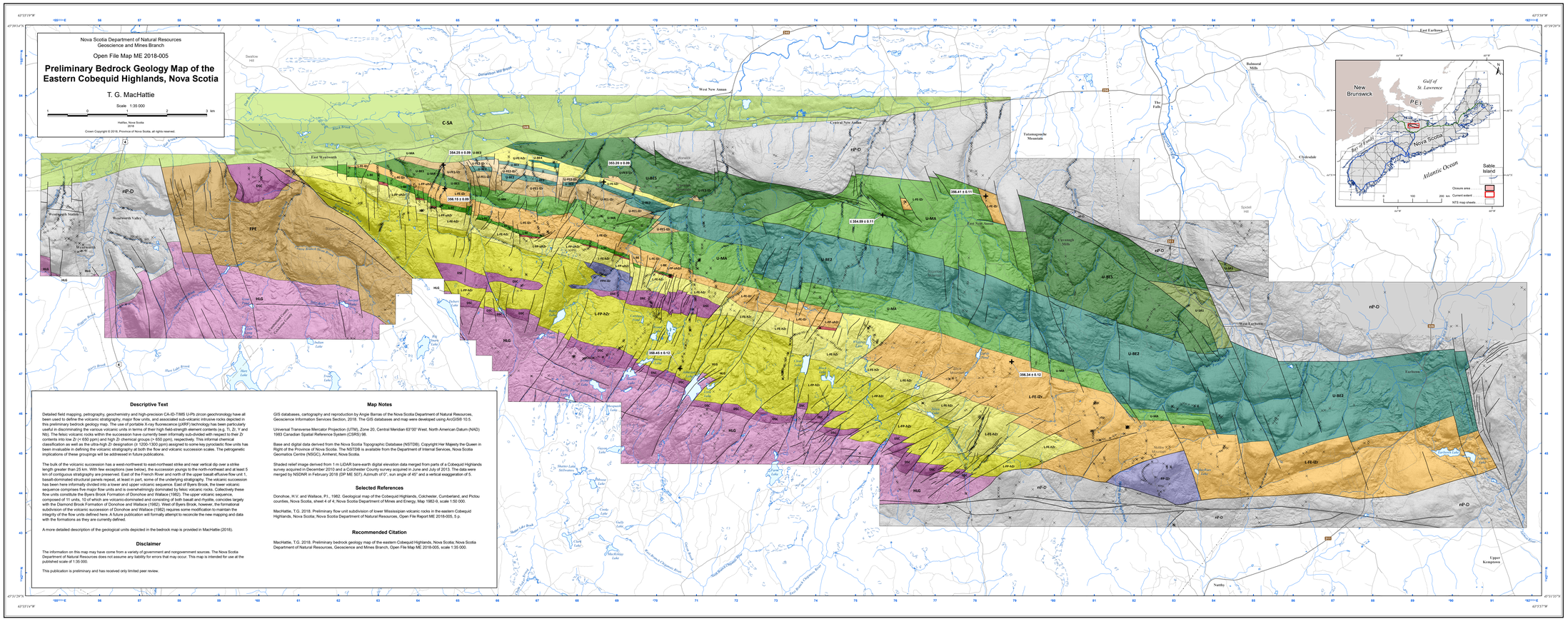

Descriptive Text

Detailed field mapping, petrography, geochemistry and high-precision CA-ID-TIMS U-Pb zircon geochronology have all been used to define the volcanic stratigraphy, major flow units, and associated sub-volcanic intrusive rocks depicted in this preliminary bedrock geology map. The use of portable X-ray fluorescence (pXRF) technology has been particularly useful in discriminating the various volcanic units in terms of their high field-strength element contents (e.g. Ti, Zr, Y and Nb). The felsic volcanic rocks within the succession have currently been informally sub-divided with respect to their Zr contents into low Zr (< 650 ppm) and high Zr chemical groups (> 650 ppm), respectively. This informal chemical classification as well as the ultra-high Zr designation (> 1200-1300 ppm) assigned to some key pyroclastic flow units has been invaluable in defining the volcanic stratigraphy at both the flow and volcanic succession scales. The petrogenetic implications of these groupings will be addressed in future publications.

The bulk of the volcanic succession has a west-northwest to east-northeast strike and near vertical dip over a strike length greater than 25 km. With few exceptions (see below), the succession youngs to the north-northeast and at least 5 km of contiguous stratigraphy are preserved. East of the French River and north of the upper basalt effusive flow unit 1, basalt-dominated structural panels repeat, at least in part, some of the underlying stratigraphy. The volcanic succession has been here informally divided into a lower and upper volcanic sequence. East of Byers Brook, the lower volcanic sequence comprises five major flow units and is overwhelmingly dominated by felsic volcanic rocks. Collectively these flow units constitute the Byers Brook Formation of Donohoe and Wallace (1982). The upper volcanic sequence, composed of 11 units, 10 of which are volcanic-dominated and consisting of both basalt and rhyolite, coincides largely with the Diamond Brook Formation of Donohoe and Wallace (1982). West of Byers Brook, however, the formational subdivision of the volcanic succession of Donohoe and Wallace (1982) requires some modification to maintain the integrity of the flow units defined here. A future publication will formally attempt to reconcile the new mapping and data with the formations as they are currently defined.

A more detailed description of the geological units depicted in the bedrock map is provided in MacHattie (2018).

Disclaimer

The information on this map may have come from a variety of government and nongovernment sources. The Nova Scotia Department of Natural Resources does not assume any liability for errors that may occur. This map is intended for use at the published scale of 1:35 000.

This publication is preliminary and has received only limited peer review.

Map Notes

GIS databases, cartography and reproduction by Angie Barras of the Nova Scotia Department of Natural Resources, Geoscience Information Services Section, 2018. The GIS databases and map were developed using ArcGIS® 10.5.

Universal Transverse Mercator Projection (UTM), Zone 20, Central Meridian 63°00' West. North American Datum (NAD) 1983 Canadian Spatial Reference System (CSRS) 98.

Base and digital data derived from the Nova Scotia Topographic Database (NSTDB). Copyright Her Majesty the Queen in Right of the Province of Nova Scotia. The NSTDB is available from the Department of Internal Services, Nova Scotia Geomatics Centre (NSGC), Amherst, Nova Scotia.

Shaded relief image derived from 1 m LiDAR bare-earth digital elevation data merged from parts of a Cobequid Highlands survey acquired in December 2010 and a Colchester County survey acquired in June and July of 2013. The data were merged by NSDNR in February 2018 (DP ME 507). Azimuth of 0°, sun angle of 45° and a vertical exaggeration of 5.

Selected References

Donohoe, H.V. and Wallace, P.I., 1982. Geological map of the Cobequid Highlands, Colchester, Cumberland, and Pictou counties, Nova Scotia, sheet 4 of 4; Nova Scotia Department of Mines and Energy, Map 1982-9, scale 1:50 000.

MacHattie, T.G. 2018. Preliminary flow unit subdivision of lower Mississipian volcanic rocks in the eastern Cobequid Highlands, Nova Scotia; Nova Scotia Department of Natural Resources, Open File Report ME 2018-005, 5 p.

Recommended Citation

MacHattie, T.G. 2018. Preliminary bedrock geology map of the eastern Cobequid Highlands, Nova Scotia; Nova Scotia Department of Natural Resources, Geoscience and Mines Branch, Open File Map ME 2018-005, scale 1:35 000.

LEGEND

PENSYLVANIAN

CUMBERLAND BASIN

CUMBERLAND SILICLASTIC ASSEMBLAGE (**C-SA**): Grey to locally maroon sandstone and conglomerate

LOWER MISSISSIPPIAN

UPPER VOLCANIC SEQUENCE

SILICLASTIC ASSEMBLAGE (**U-SA1**): Maroon sandstone, siltstone and conglomerate; minor vesicular/amygdaloidal basalt flows

UPPER BASALT EFFUSIVE FLOW UNIT 5 (**U-B15**): Vesicular/amygdaloidal basalt flows; minor maroon sandstone, siltstone and conglomerate

UPPER FELSIC EFFUSIVE FLOW UNIT 3, LOW Zr (**U-FE3-DZr**): Felsic, effusive, K-feldspar +/- quartz phyric ; spherulitic flow-banded rhyolite flows, low zirconium (Zr) type (< 650 ppm)

UPPER BASALT EFFUSIVE FLOW UNIT 4 (**U-B14**): Vesicular/amygdaloidal basalt flows

UPPER FELSIC EFFUSIVE FLOW UNIT, HIGH Zr (**U-FE-NZr**): Felsic, effusive, K-feldspar ± quartz phyric ; spherulitic, flow banded rhyolite flows, high zirconium (Zr) type (> 650 ppm); locally, flow banded zones are complexly folded and brecciated. Granophyric intergrowths of quartz and K-feldspar are common; unit is intercalated with U-BE4. A sample from this unit has a high precision CA-ID-TIMS zircon crystallization age of 353.2 ± 0.09 Ma (MacHattie and Crowley, personal communication)

UPPER BASALT EFFUSIVE FLOW UNIT 3 (**U-BE3**): Vesicular/amygdaloidal basalt flows

UPPER FELSIC EFFUSIVE FLOW UNIT 2, LOW Zr (**U-FE2-DZr**): Felsic, effusive, K-feldspar ± quartz phyric ; spherulitic, flow banded rhyolite flows, low zirconium (Zr) type (< 650 ppm); locally, flow banded zones are complexly folded and brecciated; minor welded crystal lithic tuff breccia

UPPER BASALT EFFUSIVE FLOW UNIT 2 (**U-BE2**): Vesicular/amygdaloidal basalt flows

UPPER FELSIC EFFUSIVE FLOW UNIT 1, LOW Zr (**U-FE1-DZr**): Felsic, effusive, K-feldspar ± quartz phyric ; spherulitic, flow banded rhyolite flows, low zirconium (Zr) type (< 650 ppm); locally, flow banded zones are complexly folded and brecciated. A sample from the base of this unit has a high-precision CA-ID-TIMS zircon crystallization age of 354.25 ± 0.09 Ma (MacHattie and Crowley, personal communication).

UPPER MIXED ASSEMBLAGE (**U-MA**): Vesicular/amygdaloidal basalt flows; lesser felsic syn-eruptive crystal lithic tuff breccia, moderate to intense welding, crystal (K-feldspar and quartz) and lithic content and character (juvenile to exotic) is highly variable; minor grey to black siltstone, grey sandstone and conglomerate, grey to black limestone. A sample of lithic tuff breccia was selected for high precision CA-ID-TIMS U-Pb zircon age dating. This sample yielded a very robust maximum depositional age of 354.59 ± 0.11 Ma (MacHattie and Crowley, in preparation) derived from four identical zircon analyses.

UPPER BASALT EFFUSIVE FLOW UNIT 1 (**U-BE1**): Vesicular/amygdaloidal basalt flows

LOWER VOLCANIC SEQUENCE

LOWER FELSIC EFFUSIVE FLOW UNIT, LOW Zr (**L-FE-DZr**): Felsic, effusive, K-feldspar-rich; ± quartz phyric , spherulitic, flow banded rhyolite flows, low zirconium (Zr) type (< 650 ppm), magma mixing and mingling textures are common and accentuated by flow banding; portions of this flow unit contain variably welded, K-feldspar ± quartz phyric to crystal-poor pyroclastic flows, locally they are spherulite and lithophysae-rich, like the effusive flow units they are low zirconium (Zr) type (< 650 ppm). Three samples from this unit have high precision CA-ID-TIMS zircon crystallization ages of 356.15 ± 0.09 Ma, 356.34 ± 0.12 Ma and 356.41 ± 0.11 Ma (MacHattie and Crowley, personal communication).

LOWER BASALT EFFUSIVE FLOW UNIT 1 (**L-BE**): Vesicular/amygdaloidal basalt flows, locally basalt is intercalated with L-FP-uhZr, indicating they are in part contemporaneous

LOWER FELSIC PYROCLASTIC FLOW UNIT, ULTRA-HIGH Zr (**L-FP-uhZr**): Felsic syn-eruptive crystal lithic tuff breccia, moderate to intense welding, crystal (K-feldspar and quartz) and lithic content and character (juvenile to exotic) is highly variable, ultra-high zirconium (Zr) contents (> 1200 ppm) characterize most samples from this unit

LOWER FELSIC EFFUSIVE FLOW UNIT, HIGH Zr (**L-FE-NZr**): Felsic, effusive, K-feldspar ± quartz phyric ; spherulitic, flow banded rhyolite flows, high zirconium (Zr) type (> 650 ppm); locally, flow banded zones are complexly folded and brecciated; minor grey siltstone and sandstone, felsic and mafic tuff

LOWER FELSIC PYROCLASTIC FLOW UNIT, HIGH Zr (**L-FP-NZr**): Felsic, crystal-rich (K-feldspar and quartz) and lesser crystal-poor, moderately to intensely welded tuff, mainly high zirconium (Zr) type (>650 ppm); minor felsic, moderately welded crystal-lithic tuff, non-welded felsic and mafic tuff, and grey to black siltstone, grey sandstone and conglomerate; unit is intruded by numerous fine-grained diorite dykes, especially where proximal to the diorite sill complex (DSI); also locally intruded by felsic porphyry dykes. A sample from the base of this unit has high a precision CA-ID-TIMS zircon crystallization age of 358.48 ± 0.12 Ma (MacHattie and Crowley, personal communication).

VOLCANIC SUCCESSION UNDIVIDED

UNDIVIDED FELSIC PYROCLASTIC AND EFFUSIVE FLOW UNITS (**nPE**): Felsic, crystal-rich (K-feldspar and quartz) intensely to moderately welded tuff, lesser non-welded felsic and mafic tuff, minor felsic effusive, K-feldspar ± quartz phyric , spherulitic, flow-banded rhyolite flows; high and low zirconium (Zr) types; minor black to grey siltstone

INTRUSIVE ROCKS

FELSIC PORPHYRY (**FP-DZr**): Felsic, K-feldspar ± quartz phyric porphyry, locally spherulitic; low zirconium (Zr) type

FELSIC PORPHYRY, DIORITE, HYBRID (**FPH-DZr**): Felsic, K-feldspar ± quartz phyric porphyry, locally spherulitic; low zirconium (Zr) type; fine- to medium-grained diorite; hybridized (diorite and felsic porphyry) felsic components

DIORITE SILL COMPLEX (**DSC**): Plagioclase-phyric to massive, medium- to coarse-grained diorite and gabbro; syn-plutonic micro-diorite dykes and pods are common; minor cumulate textures and glomérophyric components; mixing and mingling of variably crystalline mafic magmas is common

HART LAKE ALKALI FELDSPAR GRANITE (**HLG**): Medium- to coarse-grained alkali-feldspar granite, mafic minerals include magnetite, biotite and amphibole; minor diorite and variably hybridized (granite and diorite) felsic components

NEOPROTEROZOIC TO DEVONIAN

INTRUSIVES AND VOLCANIC AND SILICICLASTIC UNITS (**nPD**): Mafic-felsic intrusive and volcanic rocks, volcaniclastic and volcanogenic sedimentary rocks

Symbols

Station location

Radiometric date (Ma) — 356.34 ± 0.12
CA-ID-TIMS U-Pb zircon

Geological contact

Fault

Arterial highway — 4

Collector highway — 333

Local road

Seasonal, restricted or private road

Trail, track

Railway (active)

River, stream

Boundary (county)

Transmission line

Wetlands

Dam

Lake

NOVA SCOTIA

Feb 28, 2018