



**GEOLOGY BETWEEN TOODOGGONE AND STURDEE RIVERS
(94E)**

By A. Panteleyev

INTRODUCTION

Regional mapping in 'Toodoggone Volcanics' that was initiated south of Finlay River in 1981 was expanded in 1982 to cover the central portion of the volcanic belt between Toodoggone River on the north end and Sturdee River on the south. During 1982, 270 square kilometres was mapped as shown on Figure 45. The area is being actively explored for gold-silver deposits (see report by T. Schroeter, this volume).

Field mapping data was entered on Federal 1 inch to 1/2 mile (1:31 680) air photographs. The detailed information was subsequently transferred to 1:25 000 base maps prepared under contract and available from Burnett Resource Surveys Ltd. Final compilation was done on Federal 1:50 000 preliminary map sheets for NTS 94E/2, 3, 6, and 7. L. J. Diakow examined areas exhibiting hydrothermal alteration, notably silicification and clay-alunite development, as an adjunct to these regional studies. Two of the more economically interesting zones were studied in detail -- the Silver Pond (Cloud Creek) zone shown on Figure 45, and the Wrich-Awesome area, south of Finlay River. Diakow discusses both zones in a separate report in this volume.

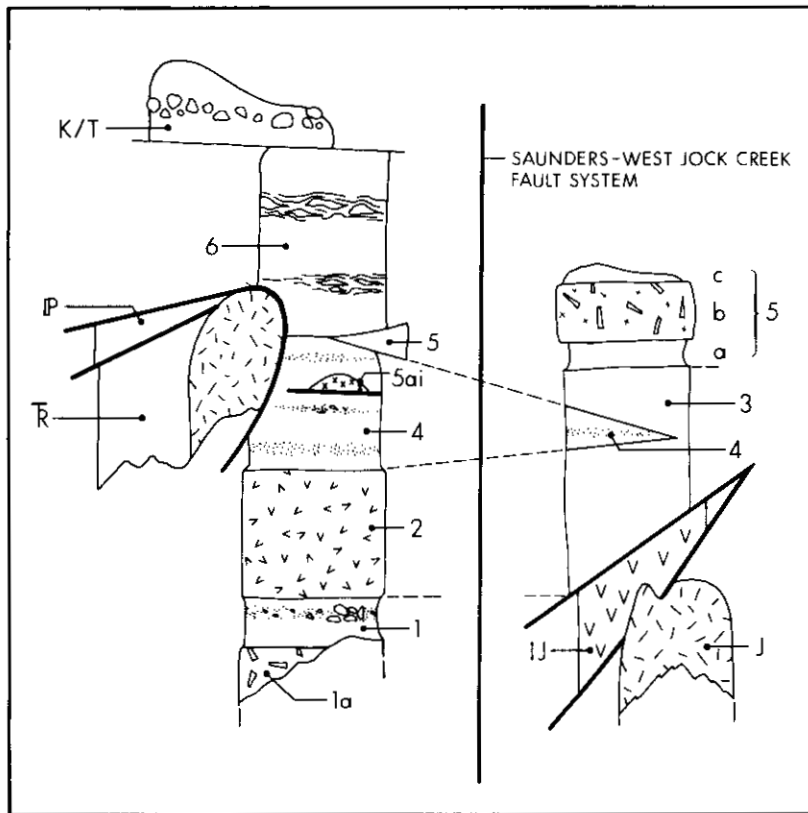
All mapping by Schroeter, Diakow, and this writer will be compiled in early 1983 and released as a preliminary map at scale 1:50 000.

GEOLOGY

Six major stratigraphic subdivisions were established as shown on Figures 45 and 46. The most widespread and continuous rock type in the Toodoggone volcanic belt is map unit 6, 'grey dacite.' The rock is distinctive in outcrop and hand specimen. The base of this unit provides the most useful stratigraphic datum plane in the map-area. The grey dacite is also the only clearly identifiable rock type that provides continuity between the 1982 map-area and the area south of Finlay River mapped in 1981 (see Panteleyev, 1982). Although other Toodoggone rocks that underlie grey dacite (map units 1 to 5) are lithologically similar north and south of Finlay River, the map units described in this report are not stratigraphic equivalents of those described in 1981. The stratigraphic section between Toodoggone and Sturdee Rivers includes the following map-units as shown on Figure 45:

Unit 1

Tuff and tuffaceous sandstone 'red beds.' A well-layered sequence of graded, feldspathic crystal-lithic ash to dust tuffs or reworked (epiclastic) tuffs. Some coarse boulder conglomerate lenses.



LEGEND

CRETACEOUS/EARLY TERTIARY

K/T SUSTUT GROUP: SANDSTONE, CONGLOMERATE

LOWER JURASSIC

"TOODOGGONE VOLCANICS"

5c "GREY DACITE" ASH FLOW UNIT

5 ANDESITE FLOWS, IN PART TRACHYANDESITE AND MINOR TUFF

5ai PYROXENE BASALT (INTRUSIVE)

4 QUARTZOSE ANDESITE PYROCLASTIC UNIT, PRE-DOMINANTLY CRYSTAL AND LITHIC-LAPILLI ASH FLOW TUFFS, WELL-LAYERED ASHFALL UNIT WITH MUCH CLAST SIZE RANGE, LESSER FLOWS, BRECCIAS, AGGLOMERATE, MINOR EPI-CLASTIC UNITS WITH LOCAL COARSE LANDSLIDE DEBRIS

2 ANDESITE FLOWS, SOME BRECCIAS, MINOR TUFFS

1 TUFFS, TUFFACEOUS SANDSTONE, CONGLOMERATE, "RED BEDS"

1a FELDSPAR PORPHYRY FLOWS (TRACHYANDESITE)

JURASSIC

V HAZELTON GROUP: ANDESITIC FLOWS, PYROCLASTIC ROCKS

TRIASSIC

T TAKLA GROUP: PYROXENE BASALT FLOWS, TUFFS, BRECCIAS

PALEOZOIC

P ASITKA 7 GROUP: LIMESTONE, IN PART MARBLE, SKARN; MINOR CHERT, ARGILLITE

5c ANDESITIC BASALT, DUST TO COARSE LAPILLI LITHIC TUFFS

5b BASALT/BASALTIC ANDESITE FLOWS

3a BASALTIC TUFFS

3 ANDESITE FLOWS, MEDIUM TO FINE GRAINED; TUFFS; INCLUDES SOME QUARTZOSE TUFF UNITS EQUIVALENT TO UNIT 4

X OMINECA INTRUSIONS: GRANODIORITE

Figure 46. Diagrammatic stratigraphic column, Toodoggone-Sturdee River area.

Unit 1a

Volcanic flow unit of undetermined extent, exposed only in Moosehorn Creek and overlain by tuffaceous red beds (unit 1). The flows consist of up to 15 per cent pink albitized plagioclase phenocrysts 3 to 6 millimetres in length in an aphanitic, dark green matrix that contains chloritized biotite and abundant very fine-grained magnetite.

Unit 2

Andesite flows -- medium-grained hornblende feldspar porphyry. Grey-green to purplish brown when fresh, pervasively oxidized to salmon pink or orange in weathered and hydrothermally altered outcrops. Sparse reddish brown apatite (?) grains to 1 millimetre in size are distinctive and characteristic of this rock type. Epidote alteration with minor amounts of associated pyrite is common. This is an extensive map unit derived from a homogeneous magma source. It consists mainly of massive flows, although some display trachytoid crystal alignment. Less common is flow breccia and there are minor amounts of pyroclastic breccia and tuff.

Unit 3

Andesite flows and tuffs -- a heterogeneous assemblage of flow and pyroclastic rocks -- predominantly hornblende feldspar porphyry flows and lithic ash tuffs. In the southeast corner of the map-area grey, fine to medium-grained crowded porphyry flows are common. Interspersed in at least three levels in the succession are quartzose lithic-crystal tuffs that are believed to be lateral equivalents to map unit 4. Map unit 3 appears to be a temporal equivalent of map unit 2 and probably inter-fingers with it.

Unit 4

Quartzose andesite pyroclastic rocks -- an extremely heterogeneous unit in terms of colour, clast size, and origin. Clasts range in size from dust to coarse blocks in breccia and compositions cover the spectrum from pure crystal tuff to solely lithic material. In detail, lava flows, breccia, agglomerate, thick crudely layered ash and blocky ash flows, occasional well-bedded ash fall deposits, and some reworked (epiclastic) units make up this map unit.

Unit 5

Andesite and trachyandesite flows -- a thin, dissected unit that caps pyroclastic rocks of map unit 4. It signals the end of explosive pyroclastic activity and the onset of lava eruptions. Flows of the bimodal suite -- andesite and trachyandesite -- are interlayered along with minor tuffs. The volume, regional extent, and significance of the alkaline rocks is not currently known.

Units 5a, 5b, and 5c

A basaltic sequence found only east of the major Saunders Creek-West Jock Creek fault system. The sequence contains well-layered ash tuffs (unit 5a), coarse-grained hornblende plagioclase porphyry flows (unit 5b), and mixed ash to coarse lapilli tuff beds (unit 5c). The rocks are strongly epidotized and, where oxidized, are stained a hematitic, deep purple ochre colour.

Unit 5ai

Pyroxene basalt intrusion -- possibly a laccolith or sill. The rock is made up of 5 to 10 per cent pyroxene phenocrysts in a matrix of plagioclase microlaths. It is generally unaltered but near the faulted western contact it is extensively zeolitized.

Unit 6

Grey dacite -- grey to grey-green rocks that weather dark grey to brown and form resistant, blocky-jointed scarps. The rocks contain up to 25 per cent biotite, hornblende, quartz, feldspar phenocrysts and abundant clasts of quartz feldspar porphyry. No internal banding is present in the unit but compaction, clast orientation, and locally developed welding impart a weak layering-foliation to outcrops. The base of the unit most commonly is a relatively clast-poor, chloritic, devitrified, vitrophyric crystal tuff. Locally it is a coarse fragmental ash flow with abundant, rounded clasts up to 10 centimetres in diameter. This coarse pyroclastic rock probably formed as a turbidity lag deposit that reflects turbulence developed by local topographic features along the base of an overall laminar ash flow.

AGE OF TOODGGONE VOLCANICS

Radiometric dates for hornblende and rubidium-strontium samples from volcanic and related intrusive rocks in the Toodoggone area range from 179 to 207 Ma (Gabrielse, *et al.*, 1980). A sample of alunite has been reported to be 190 ± 7 Ma (Schroeter, 1982). A new date of 204 Ma is the first to be reported from biotite in Toodoggone volcanic rocks. The sample of biotite-bearing quartzose crystal ash tuff was collected south of Finlay River from rocks of Panteleyev's 1981 map unit 5a. These rocks are probably equivalent to map unit 4 in this report. The 204 Ma date corresponds to 202 and 207 Ma dates from nearby granitic intrusions at Kemess deposit (Cann and Godwin, 1980). Collectively, radiometric dates from south of Finlay River to the Stikine River suggest that Toodoggone volcanics were deposited over a 20-million-year period from approximately 200 to 180 Ma.

Sample Data:

Sample No.	Location	Material Analysed	% K	Ar ^{*40}	% Rad. Ar ^{*40}	Apparent Age (Ma)
81AP-T28	57°05'38"N 126°39'30"W	Biotope	6.87±0.02 (3)	25.743	97.5	204±7

NOTES

% K determined by the Analytical Laboratory, Ministry of Energy, Mines and Petroleum Resources; number in parenthesis refers to number of K analyses.
Ar determination and age calculation by J. E. Hrakal, University of British Columbia.
Constants used: $\lambda = 0.581 \times 10^{-10} \text{yr}^{-1}$; $\lambda^6 = 4.96 \times 10^{-10} \text{yr}^{-1}$; $K^{40}/K = 1.167 \times 10^{-4}$.

DISCUSSION

The volcanic assemblage mapped represents a subaerial, predominantly pyroclastic accumulation that was probably restricted to a relatively small island or island chain. Magma underwent little differentiation, judging from the preponderance of andesitic rocks. Some differentiation took place to produce quartzose andesitic rocks that are transitional to dacite. True dacite erupted only at the end of pyroclastic activity that produced the grey dacite ash flows. Small, probably isolated, individual magma chambers produced localized basaltic and trachytic volcanic rocks and small intrusions. No rhyolite has been found. Hydrothermal alteration produced pale, quartz-bearing, commonly banded rocks that resemble rhyolite. The altered rocks, which are composed of quartz grains, clay minerals, and alunite, are invariably localized in fault zones.

The grey dacite is interpreted to be a massive ash flow sheet or sheets that acted as a single cooling unit. It is at least 250 metres thick and covered an area at least 15 kilometres by 40 kilometres. The volume of the grey dacite sheet is a minimum of 125 cubic kilometres, which is equivalent to major ash flow sheets described in other volcanic fields (for example, see Steven and Lipman, 1976). Compared to ash flows in the San Juan volcanic region of Colorado, the grey dacite map unit ranks as a 'moderate volume ash flow.'

Sites of mineralization/alteration do not appear to have any simple lithologic control although mineralization tends to favour andesitic flows and flow contacts with tuffs rather than pyroclastic rocks. This is possibly a consequence of hydrothermal fluids being channeled by well-defined, long-lived fracture/fault systems in andesite. In contrast, hydrothermal fluids that entered pyroclastic units became dispersed and diffused by intergranular flow in the highly porous and permeable rocks. In addition, fluid-rock interaction in andesites was minimal as opposed

to the strongly hydrothermally altered pyroclastic rocks where much alteration of glass shards and crystals took place to produce abundant clay minerals.

Volcanic-related hydrothermal activity was controlled by older faults and fracture zones; many of these trend northerly to north-northeasterly. The altered zones are independent of the predominantly northwesterly-southeasterly trending younger faults shown on Figure 45.

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