TOODOGGONE VOLCANICS SOUTH OF FINLAY RIVER

(94E/2)

By A. Panteleyev

Systematic geologic mapping was started in August in the Toodoggone map-area, 94E, in order to describe lithologies, stratigraphy, structure, and mineralization of the 'Toodoggone volcanics' (Carter, 1971). A major objective of this program was to determine the extent of the volcanic belt south of Finlay River. Work in the area was done in conjunction with T.G. Schroeter, District Geologist, Smithers (see accompanying report, this volume) and L.J. Diakow, currently a graduate student at the University of Western Ontario. In 1982 this cooperative mapping will be concentrated in the area north of Finlay River and extend toward the northern boundary of the Toodoggone volcanics near the Chukachida River.

GEOLOGY

The Toodoggone volcanics form a distinct regional map unit consisting mainly of airfall ash tuffs with subordinate ashflows, coarse pyroclastics, lava flows, and lenses of epiclastic sedimentary rocks. This assemblage forms a northwesterly trending belt at least 90 kilometres long and 25 kilometres wide along the northeastern margin of the Sustut basin. From Finlay River Toodoggone rocks were traced as a continuous map unit for 27 kilometres southward. They extend beyond the boundary of map-area 94E and continue for about 2 kilometres into McConnell Creek map-area, 94D (see Figure 1).

At its southern and southwestern boundary, rocks of the Toodoggone volcanic belt appear to be structurally conformable with Takla rocks. Alternatively, they may overlie them with gentle angular unconformity. Elsewhere Toodoggone volcanics are generally in fault contact with bedded Takla, bedded Hazelton or Omineca intrusive rocks. At least locally, Omineca granitic rocks intrude Toodoggone volcanics. Along its southeast boundary the Toodoggone volcanic belt is overlapped by Paleozoic Asitka and Triassic Takla rocks. The contact area is a series of stacked thrust plates. In this region Toodoggone rocks dip steeply and Z-shaped northerly trending folds with amplitudes of at least 20 metres occur. This is in marked contrast to the area further north in the volcanic belt where gently dipping beds in tilted fault blocks or broad open folds with horizontal axes are the norm.

In detail, six stratigraphic subdivisions of Toodoggone volcanic rocks were made south of Finlay River. These are based on general outcrop appearance, rock mineralogy, texture, and mode of deposition. The geologic section there is probably the most complete section exposed anywhere in the Toodoggone volcanic belt. The basal unit (unit 1) is

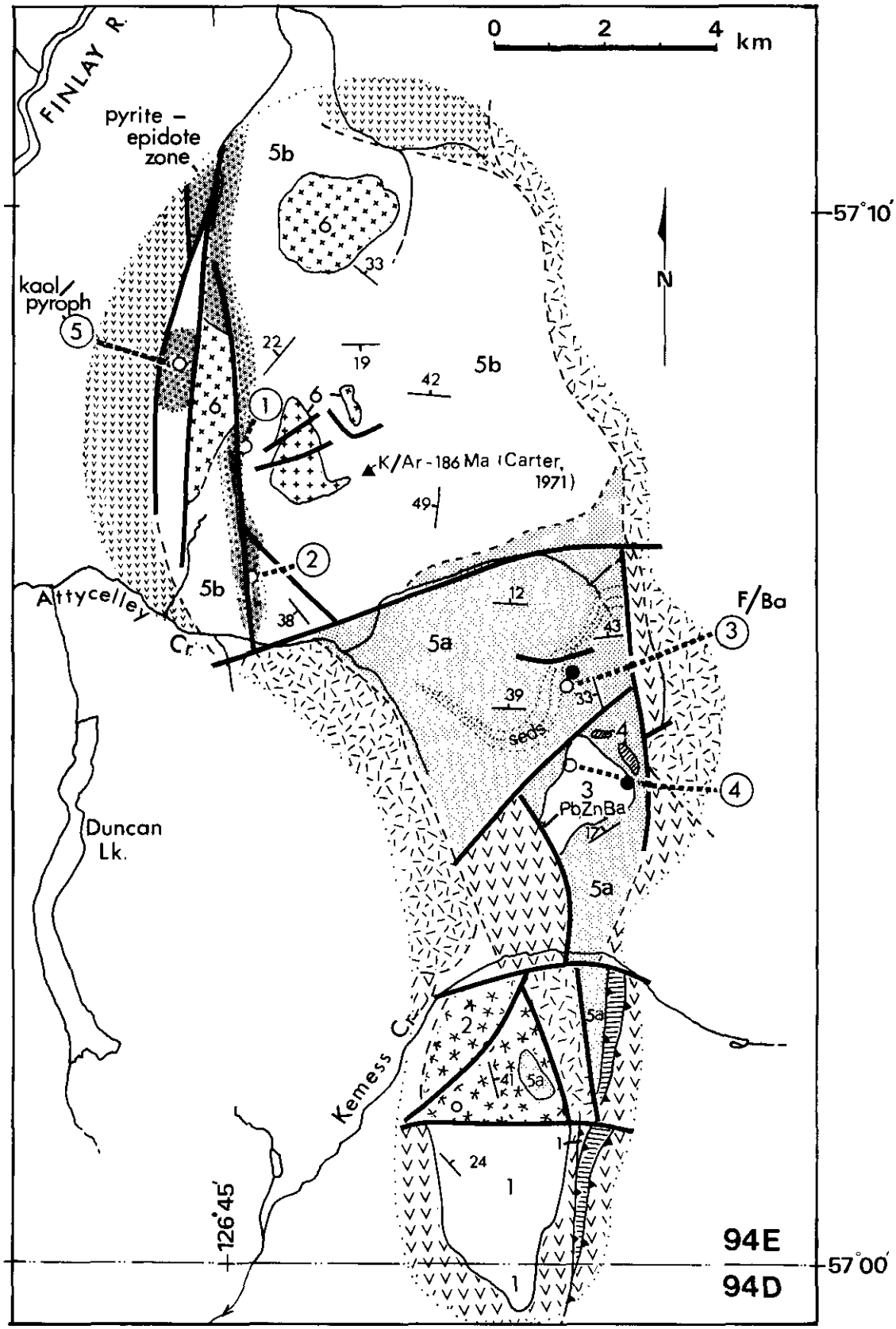

Figure 1. Geology of the area south of Finlay River, showing southward extension of Toodoggone volcanics.

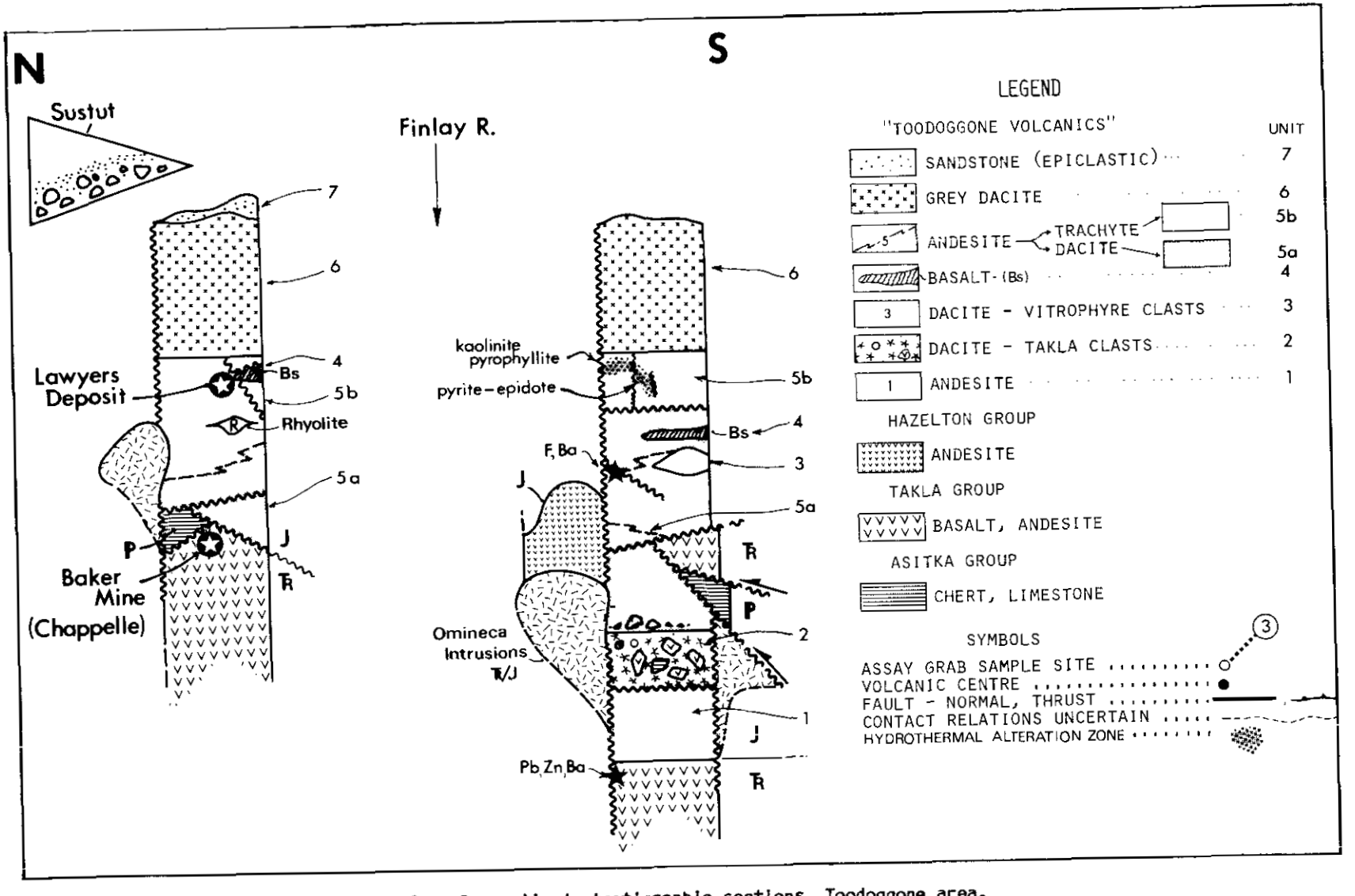

Figure 2. Generalized stratigraphic sections, Toodoggone area.

exposed southeast of Kemess Creek; successively younger map units crop out to the north. The section is as follows:

Unit 1: Andesite - purple to brown and maroon, fine-grained hornblende feldspar porphyry flows. Closer to the southern boundary flows are interfingered with recessive mauve to pink airfall crystal ash tuff. Along the southern contact crystal ash tuff forms a thin veneer on Takla 'basement.'

Unit 2: Dacite - grey to pale green lithic ash to lapilli tuff and crystal-lithic ash tuff. Outcrops are resistant, dark grey in colour, and massive in appearance. There is no obvious bedding. Some indication of layering is given by alignment of lapilli and breccia-sized clasts. Characteristically this unit has clasts of Takla rock; rarely it carries Asitka clasts.

Unit 3: Dacite - the rock is variably brown to orange or grey, biotite (chloritized) quartz feldspar crystal-lithic ash and lapilli tuff. The orange clasts consist of medium-grained feldspar phenocrysts set in a vitrophyric matrix. In thin section, the vitrophyre consists of radiating spherules of quartz-adularia-stilbite. The unit also includes crystal ash tuff, lapilli tuff, and rare lahar lenses.

Unit 4: Basalt - dark green to maroon, amygdaloidal feldspar porphyry flows that are up to 50 metres in total thickness. These cap up to 10 metres of flow or coarse pyroclastic breccia. Mafic phenocrysts are pervasively chloritized.

Unit 5: Andesite (Dacite, Trachyte) - grey, purple, and pink, predominantly hornblende-biotite-quartz-bearing feldspar crystal ash and crystal-lithic ash tuffs with some lapilli tuff and lahar deposits and rare agglomerates. Immature sandstone and conglomerate, that is in part fanglomerate, form epiclastic lenses up to 50 metres in thickness but of local extent. Deposition of tuffs was mainly from airfall deposits. Outcrops are stratified, poorly consolidated, and recessive. Despite their recessive nature, rocks of map unit 5 form the thickest and most extensive unit in the Toodoggone area; its total thickness apparently exceeds 600 metres.

Unit 6: Dacite - grey to grey-green rocks that weather dark grey to brown. The rocks form resistant outcrops that commonly give rise to blocky jointed scarps. The rocks are relatively homogeneous with biotite-hornblende-quartz-feldspar-dacite porphyry clasts set in crystal-ash tuff matrix of similar composition. The clasts are oriented so they impart a faint foliation to the rock. Compaction is locally evident, but there is no evidence of welding in this unit. The unit apparently represents a subaerial ash flow sheet that was up to 150 metres in thickness.

Map units 3, 4, and 5 are largely penecontemporaneous. Each was deposited from separate, adjoining volcanic vents. Map units 3 and 4 are very localized but unit 5 is widespread.

Two small volcanic centres were recognized and are shown on Figure 1 as solid black dots. The smaller centre in map unit 3 is approximately 35 metres in diameter and consists of finely comminuted dark brown powdery dust and ash vent filling with bombs up to 60 centimetres in size. The larger volcanic centre near sample site AXT 3 has a 100-metre-wide feldspar porphyry intrusive neck emplaced along the margin of an eruptive vent of about the same size. This centre is surrounded in a 1-kilometre-sized area by agglomerate and breccia. Outward from the coarse pyroclastic rocks are flanking aprons of lithic lapilli tuff grading to ash tuff. In both volcanic centres solfataric alteration rims up to 10 metres wide mark the periphery of the volcanic vent.

Map units 5 and 6 are known to occur north of Finlay River. Both units are found east and northeast of Baker mine and map unit 5 forms the country rock in the area of the Lawyers deposit. Lacustrine epiclastic sedimentary rocks (unit 7) are found in a few localities north of Finlay River. Map units 5, 6, and 7 as described here correspond to map units 1 to 4 as described by Schroeter (Geological Fieldwork, 1980, Paper 1981-1, p. 125). The correspondence is as follows:

Map unit (this study, Figures 1 and 2)	Map unit (Schroeter, 1980)
5a	1 Lower Volcanic Div.
5b	2 Middle Volcanic Div.
6	3 Upper Volcanic-Intrusive Div.
7	4 Volcanic-Sedimentary Div.

DISCUSSION - MAP UNIT 5

Preliminary chemical data for Toodoggone volcanic rocks (see Schroeter, this report) show that the majority are andesitic. However, the amount of quartz, commonly as quartz crystals in ash tuff, varies from negligible to as much as 15 per cent. Therefore, when modal quartz was conspicuous in a series of outcrops, the rocks were mapped as 'dacite.' For example, the area dominated by purplish quartz-bearing volcanic rocks was distinguished as map unit 5a (Figure 1). Elsewhere, and probably overlying map unit 5a, quartz-poor rocks are andesitic (map unit 5b). Within these rocks Schroeter has found areas containing more than 10 per cent K_2O. The 'andesites,' therefore, of map unit 5b are, at least in part, trachyte.

The geologic map (Figure 1) is generalized and simplified. The northern part (unit 5b) is predominantly andesitic crystal tuff and the southern part (unit 5a) quartz-bearing lithic-crystal tuff and, therefore, 'dacitic.' In reality there are significant vertical and lateral variations in map unit 5. Quartz-bearing and quartz-poor rocks interfinger because slightly different rock types were erupting penecontemporane-

ously from adjoining eruptive centres. In the southernmost part of the map-area much of the basal part of unit 5a is crystal-lithic tuff. The matrix is quartz-rich crystal ash tuff which carries numerous granitic clasts.

ALTERATION AND MINERALIZATION

Hydrothermal alteration in the mapped area is fracture controlled and consists mainly of the zeolites laumontite and stilbite with calcite; it may be deuteric. Calcite, natrolite, and thompsonite fill amygdales in dyke rocks but, overall, are rare. Intergranular calcite is pervasive in the epiclastic rocks. Throughout the district large areas of tuffs contain epidote clots and feldspars are altered to a pink colour.

Zones in which fine-grained pyrite accompanies the epidote are of more economic interest. One such area occurs in a strongly faulted zone in map-unit 5b between Attycelley Creek and Finlay River. A large area of pervasive clay alteration is developed in the most westerly fault bounded block in this vicinity. Clay minerals identified by X-ray diffraction include kaolinite and pyrophyllite. A composite sample of rock chips grabbed from a tenuous quartz stockwork-veinlet system in the clay-altered zone yielded 676 ppb gold (sample AXT 5). Other composite grab samples comprised of chips of quartz-veined material from silicified volcanic rocks contain trace amounts of gold. Values are shown in Table 1 (see Figure 1 for locations).

TABLE 1. COMPOSITE GRAB SAMPLES FROM SILICIFIED ZONES

Sample	Au ppb	Ag ppm
AXT 1	26	<10
AXT 2	162	<10
AXT 3	202	<10
AXT 4	39	<10
AXT 5	676	<10

Two occurrences of vein or breccia mineralization are known in the map-area. One is at sample site 3 (AXT 3) where green fluorite and barite accompanies hematitic chalcedony and calcite in a fault zone. The fault may be a radial structure related to the larger of the two small volcanic centres described previously. The second occurrence (shown on Figure 1 as Pb, Zn, Ba) is a quartz-calcite vein with base metal-barite mineralization. It occurs along the faulted contact between Toodoggone rocks and Takla rocks containing a porphyritic syenite dyke.

CONCLUSIONS

The 'Toodoggone volcanics' form a distinctive sequence of subaerial volcanic rocks that can be readily subdivided into a number of lithologically similar map units. Some map units are distributed throughout the volcanic belt, others are very localized.

Published radiometric dates vary from 179 to 189 Ma (Gabrielse, et al., 1980). These, as well as a new date on hydrothermal alunite of 190 Ma (see Schroeter, this volume), suggest an Early Jurassic age of deposition and related mineralization. These age data are compatible with the observation that Toodoggone volcanics rest directly on Triassic Takla rocks and can be correlated in age with older parts of the Hazelton Group.

The region south of Finlay River has similar lithologies, fault zones, and evidence of hydrothermal activity as the mineralized terrane of the Toodoggone epithermal gold-silver camp north of Finlay River. The area shown on Figure 1 appears to offer bountiful opportunities for additional epithermal deposits. Close attention should be paid to larger fracture/fault zones with associated hydrothermal alteration, particularly if there is silicification. Attention should also be paid to bleached clay or alunite-bearing zones that might represent low-pH cappings over buried precious metal deposits. All silicified zones, including breccias and weakly developed chalcedonic veinlet systems and stockworks, should be sampled for gold.

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