A COMPARISON OF VOLCANIC STRATIGRAPHY, STRUCTURE, AND HYDROTHERMAL ALTERATION OF THE SILVER POND (CLOUD CREEK) AND WRICH-AWESOME CLAIM GROUPS, TOODOGGONE RIVER

(94E)

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INTRODUCTION

The 'Toodoggone Volcanics' comprise a northwest-trending belt at least 90 kilometres long and 15 kilometres wide, located 300 kilometres north of Smithers. They are an Early Jurassic, predominantly subaerial, calc-alkaline suite probably deposited in an island-arc environment. The regional stratigraphic section includes a base of andesitic flows which interfinger with and are overlain by flows and pyroclastic rocks of andesitic to dacitic composition (Panteleyev, 1983, this volume). Silver and gold, principally as argentite and electrum (Schroeter, 1981), occur in discordant quartz veins and grossly stratabound stockworks. On the other hand, pervasive siliceous zones which are stratiform and strata-bound appear to contain only minor amounts of precious metal mineralization although erratic high values are common. The vein and stockwork occurrences have sharp boundaries and narrow alteration halos; concordant siliceous zones are diffuse with extensive wallrock alteration characterized by clay minerals, alunite, and barite.

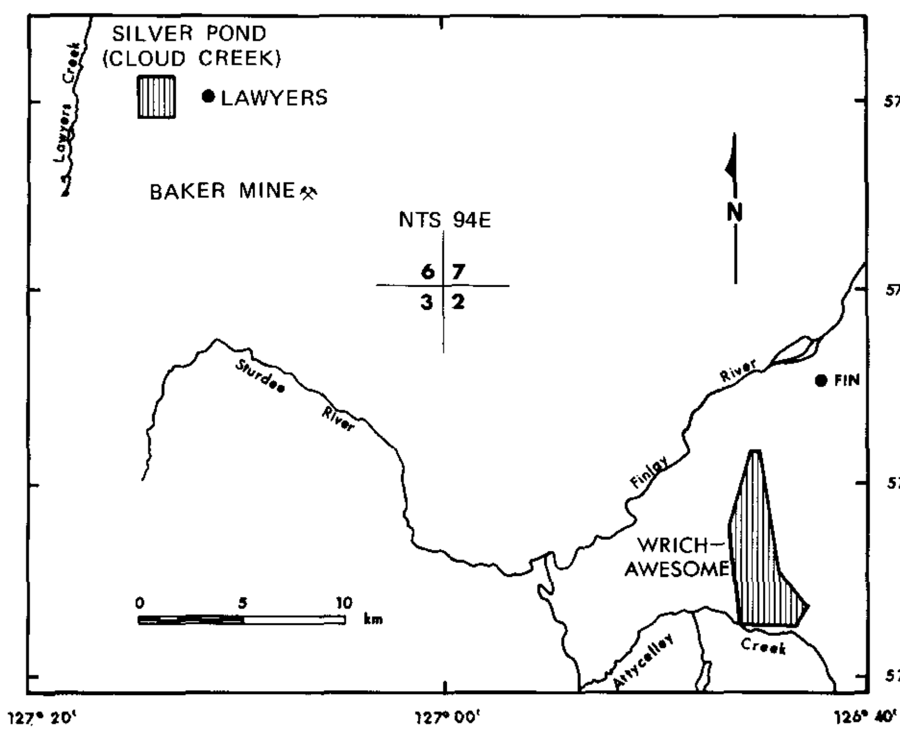

Figure 42. Location map for the Silver Pond (Cloud Creek) and Wrich-Awesome occurrences.

This research addresses the problem of distribution and variability in *morphology and wallrock alteration of these two types of silica* occurrences by analysing two occurrences. The Wrich-Awesome, which represents the vein and stockwork type, and Silver Pond (Cloud Creek), a pervasive siliceous zone (Fig. 42). Each area was mapped at 1:5000. Approximately 150 hand specimens of altered rock and 58 chip samples of siliceous rock were collected. The siliceous samples are currently being analysed for 16 elements including gold and silver; alteration assemblages are being defined by X-ray analysis.

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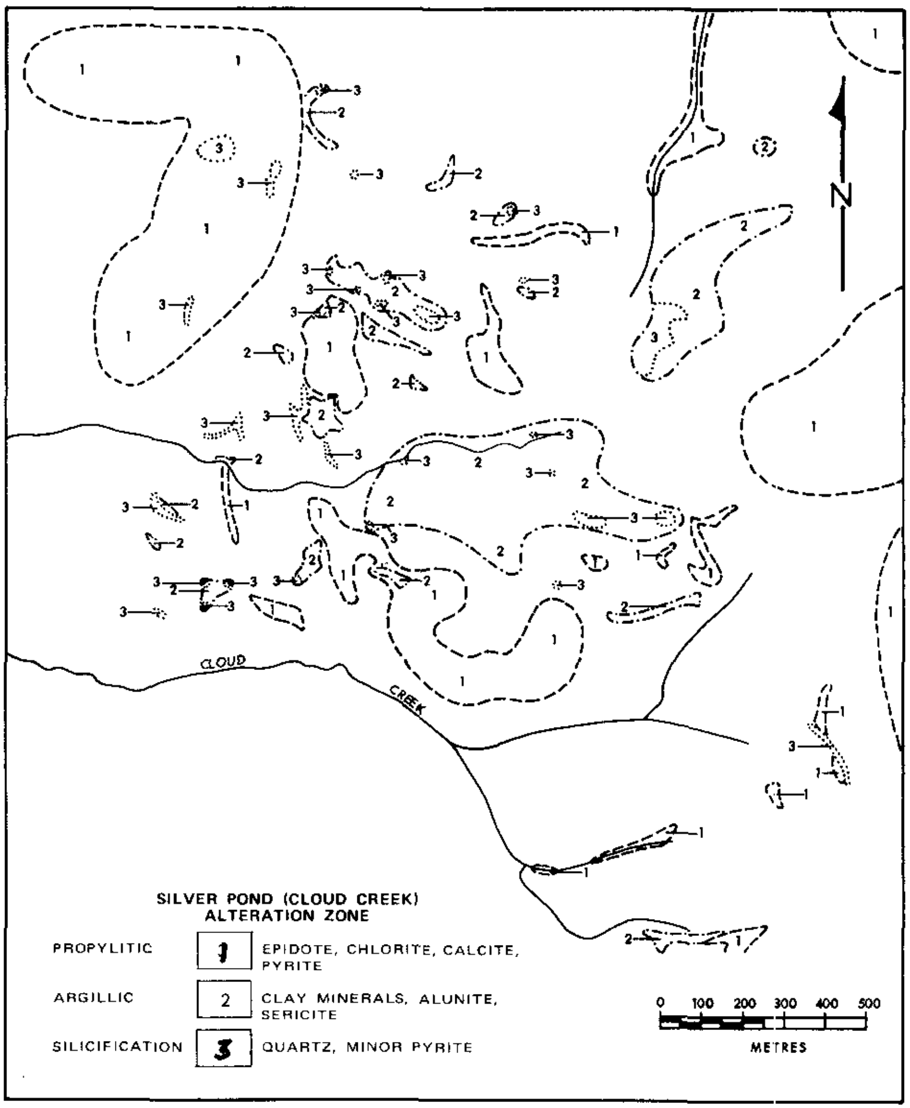

Figure 43. Alteration mineral zoning in the Silver Pond (Cloud Creek) area.

SILVER POND (CLOUD CREEK) AREA

LOCATION AND GENERAL GEOLOGY

The Silver Pond (Cloud Creek) occurrence (Silver Pond, Silver Sun, Silver Creek claims) is approximately 2 kilometres west of the Lawyers prospect. It is a 5-kilometre-square area of low relief that is underlain by porphyritic andesite with subordinate interbeds of lithic lapilli tuff and agglomerate. Attitudes measured from tuffaceous beds strike consistently northeast with dips of less than 20 degrees to the northwest. Exposures of agglomerate occur in only one fault block that is on the south-facing slopes immediately north of Cloud Creek.

The area is segmented by a network of faults which acted as channelways for hydrothermal fluids. Dykes of syenite offset the layered rocks and are locally altered; perhaps they occupy early faults which were reactivated later to provide access to hydrothermal fluids. A fresh syenite dyke dismembered by a series of *en echelon* faults indicates that more more than one phase of faulting affected the area.

ALTERATION

The Silver Pond (Cloud Creek) alteration zone is circular in outline with a diameter of 2 kilometres. A number of isolated 'patches' of intermediate-advanced argillic alteration and silicification occupy the central zone. Alteration grades laterally into an outer propylitic zone (Fig. 43).

INTERMEDIATE-ADVANCED ARGILLIC ZONE

In this zone secondary quartz, clay minerals, sericite, and alunite replace primary minerals in porphyritic andesites. Where microcrystalline quartz is most abundant there are low-lying mounds of undetermined thickness that are up to 150 metres by 50 metres in size. In these mounds the original porphyritic texture of the andesite is almost completely obliterated; only outlines of relict feldspar phenocrysts and biotite crystals remain. Pyrite is rare, occurring as fine, disseminated grains in quartz. Barite commonly occurs with quartz as crystal aggregates lining cavities or as irregular greasy white clots up to 3 centimetres across.

A recessive zone partially to completely encloses all siliceous occurrences. Typically these rocks are white with yellow-orange surface oxidation, display a remnant porphyritic texture, and are composed almost entirely of clay minerals. Dickite, kaolinite, montmorillonite, and illite are the primary constituents; alunite and sericite are subordinate. The stratiform nature of 'white' rocks with co-spatial pervasive silica occurrences suggests that a temporal relationship exists. This relationship might be due in part to primary bed porosity in underlying tuffs that enabled fluid movement along the base and through fractures in the porphyritic andesite. Red staining is imparted by hematite and goethite; commonly brilliant hues of irridescent green and blue occur on fracture surfaces.

A younger phase of silica emplacement formed discontinuous veins up to 2 centimetres wide that consist of terminated quartz crystals and lesser chalcedonic quartz. They cut both white rocks and syenite.

PROPYLITIC ZONE

This chlorite-carbonate-epidote alteration zone is widespread and extends beyond the boundary of the mapped area at Silver Pond. In the transitional area between the argillic and propylitic zones plagioclase phenocrysts show signs of corrosion and alteration to white clay and calcite, and amphibole is commonly replaced by chlorite. Fine-grained, disseminated pyrite and magnetite are ubiquitous within this transitional area, but each rarely constitutes more than 3 per cent of the rock.

Oxidation of pyrite and magnetite occurs throughout the alteration system but does not appear to penetrate deeply into the rocks. Further, in areas of propylitic chlorite-carbonate-epidote alteration, intensive 'bleaching' and replacement of the rock by clay minerals is absent. These observations suggest that the broad patterns of alteration observed in the Silver Pond area are hypogene.

WRICH-AWESOME AREA

LOCATION AND GENERAL GEOLOGY

The Wrich-Awesome area is 25 kilometres southeast of Baker minesite between Attycelley Creek and Finlay River (Fig. 42). Panteleyev (1982) presented a compilation of the regional geology south of Finlay River. The geology and distribution of known quartz stockwork and vein occurrences within the study area are shown on Figure 44. Porphyritic andesite flows with intervening beds of crystal lithic tuff underlie the majority of the mapped area. These rocks correspond with Panteleyev's map unit 5b and grade upward into quartzose tuffs that are similar to the overlying grey dacitic ash flow tuff (unit 6, Panteleyev, 1982). Takla Group pyroxene basalt, limestone, and chert crop out along the western margin of the map-area. A fault relationship between Takla and Toodoggone volcanic rocks is indicated. Takla chert beds outline chevron-style folds with amplitudes up to 7 metres and most Takla rocks dip steeply northeast as opposed to shallow westward dips in the nearby Toodoggone rocks. Takla rocks are also exposed in a fault-bounded wedge directly north of Attycelley Creek. Coarse-grained quartz monzonite is exposed where the overlying Toodoggone rocks have been removed by erosion in the northern part of the area.

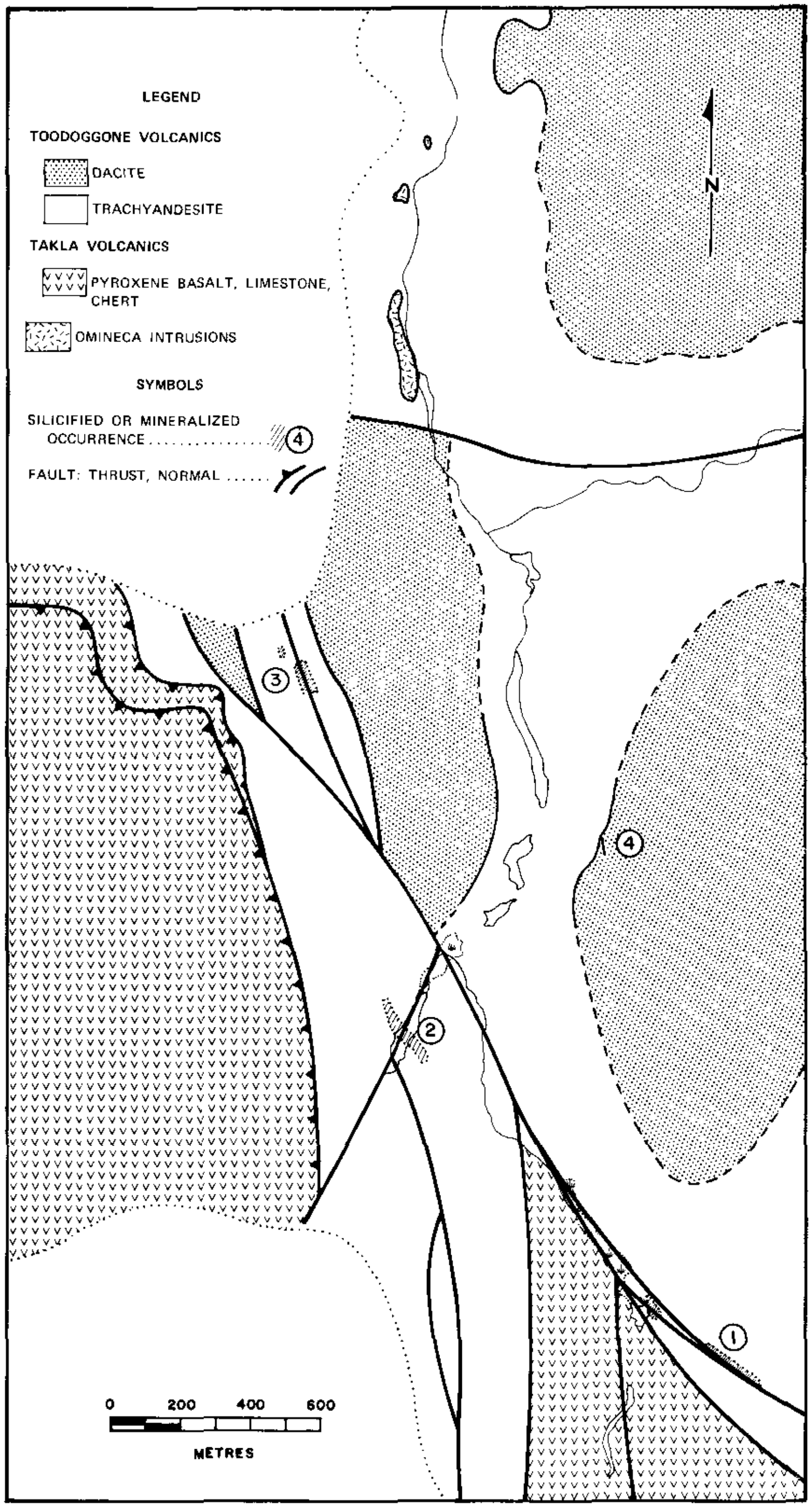

Figure 44. Geology and distribution of silica occurrences in the Wrich-Awesome area.

ALTERATION

A tabular, discontinuous zone characterized by silicification and clay minerals is aligned subparallel to a major northwest-trending fault zone (Fig. 44). Quartz stockwork and vein occurrences designated by numbers 1 and 2 on Figure 44, form narrow subvertical zones containing individual veins that are up to 4 centimetres wide in brecciated trachyandesite. Quartz in the veins occurs mainly as clear terminated crystals; there are lesser amounts of amethystine quartz. Chalcedonic silica, which is white or tinted to shades of red and green by hematite and chlorite, forms banded veins that crosscut the older, clear quartz veins. Calcite commonly fills voids within the clear crystalline veins.

A tabular zone on the Wrich claims (3 on Fig. 44), approximately 100 metres wide, is outlined by pale, clay-altered porphyritic rocks and confined to a fault-bounded area. The pale colour of these rocks reflects replacement of phenocrysts and matrix material in the host andesite by a mixture of white quartz and clay minerals. X-ray analysis showed that the white rocks contain kaolinite and minor amounts of pyrophyllite (Panteleyev, 1982). Widespread hematite and limonite impart a rusty colour to outcrop surfaces.

The quartz-kaolinite assemblage grades outward into a larger zone characterized by chlorite-calcite-epidote-pyrite alteration. This propylitic assemblage characterizes the entire trachyandesite unit and also occurs in the grey dacite. In the area mapped, the intensity of alteration decreases away from fault zones suggesting that it is fracture controlled. Pyrite occurs as fine-grained disseminations in the altered rocks; it averages 1 to 2 per cent generally but exceeds 5 per cent within one-half kilometre of intrusive rocks that lie to the north. Fine-grained disseminated magnetite is also present in trachyandesite and dacite. 'Reddening' of feldspar phenocrysts is a phenomenon that becomes more pronounced adjacent to vein and stockwork occurrences in the area. It might be caused by albitization and oxidation of magnetite or it might be alteration to K-feldspar.

MINERALIZATION

The only mineralization observed in the Wrich-Awesome area occurs within a narrow shear zone in grey dacite at location 4 on Figure 44. The occurrence consists of blebs of galena in a gangue of quartz, chlorite, epidote, and pyrite. Although this occurrence is small, it is important because it represents one of only two known mineralized occurrences in the grey dacite map unit.

SUMMARY

Hydrothermal fluids apparently travelled along fractured zones and altered surrounding volcanic rocks to produce two distinct types of silica occurrences in the Toodoggone belt. In the Wrich-Awesome area, quartz stockwork veins are related to a northwest-trending fault zone that appears to be an important control for silica-kaolinite-pyrophyllite and, to a lesser extent, chlorite-carbonate-epidote-pyrite alteration. In Silver Pond (Cloud Creek) area zones of silicification and kaolinite-dickite-alunite alteration appear to be localized at the base of a relatively flat-lying porphyritic andesite unit. Perhaps primary bed porosity governed the shape and distribution of alteration in this area.

Chip samples from 58 sites at Silver Pond (Cloud Creek) reveal consistently low gold values. Only 11 samples had detectable gold (greater than 20 ppb); four were in the 48 to 55 ppb range, and one was 164 ppb. The results are consistent with an acid-leached clay-silica capping containing the sulphate minerals alunite and barite. Other metals show little concentration in the altered zone with the exception of manganese which occurs consistently in the 600 to 800 ppm range and barium from 0.15 to 0.4 per cent. These values are consistent with results for a wide variety of elements reported by Schroeter (Geological Fieldwork, 1981, Paper 1982-1, pp. 126-128).

In the Wrich-Awesome area, four grab samples from silicified zones shown on Figure 44 give the following results:

	Au ppb	Ag ppm
Site 1 (Awesome)	24	1.25
Site 1 (Awesome)	<20	<0.4
Site 2	66	60.8
Site 3	<20	6.76

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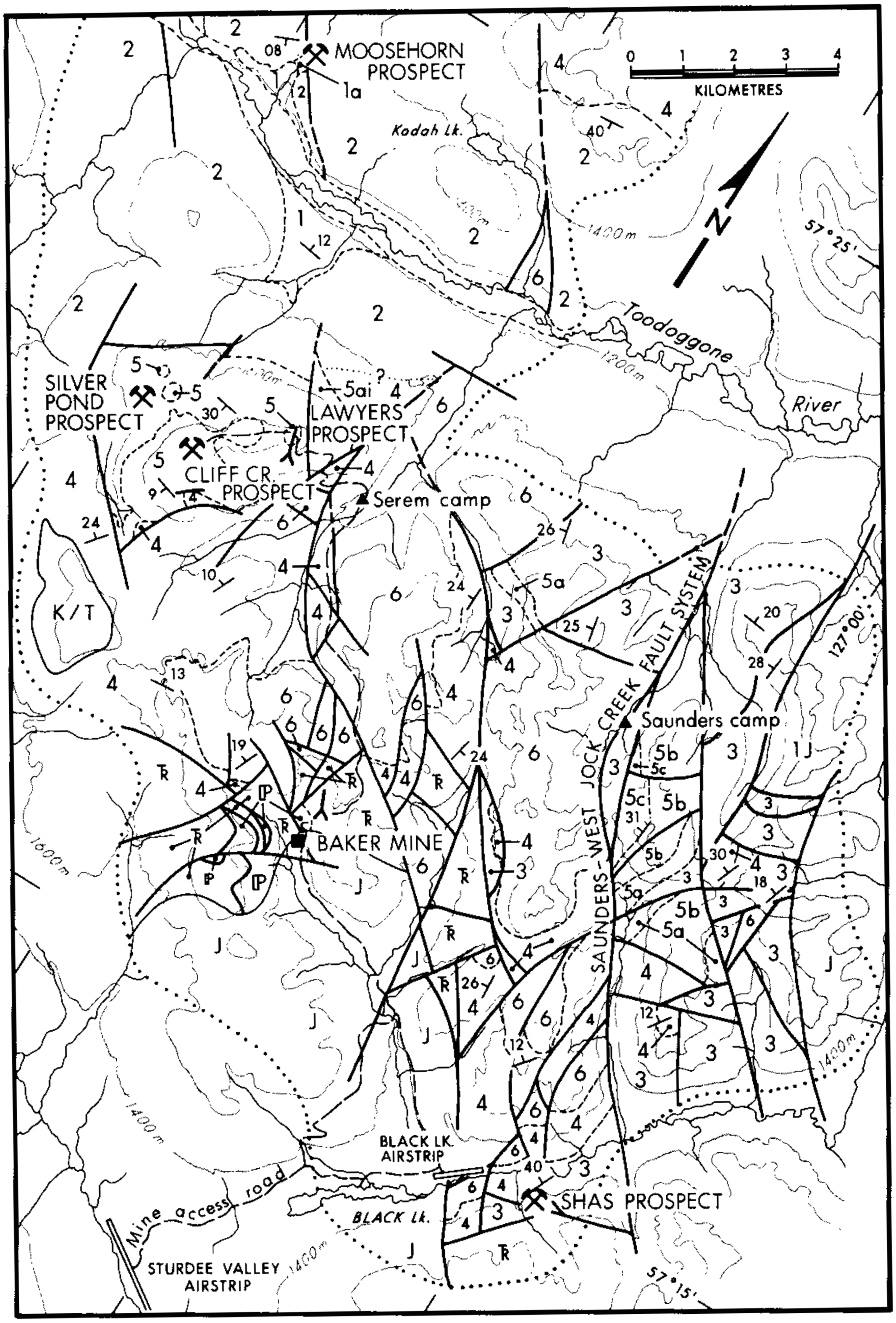

Figure 45. Geology between Toodoggone and Sturdee Rivers.