U-PB GEOCHRONOLOGY, GEOCHEMISTRY AND ND ISOTOPIC SYSTEMATICS OF THE SITLIKA ASSEMBLAGE, CENTRAL BRITISH COLUMBIA

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(MDRU contribution 82)
(British Columbia Ministry of Employment and Investment contribution to the Nechako National Mapping Program)

KEYWORDS: Sitlika assemblage, U-Pb geochronology, Permian, Early Triassic, tonalite, rhyolite, bimodal, tholeiitic, Kutcho Assemblage

INTRODUCTION

Rocks of the Sitlika assemblage occur within the eastern Sitlika Range and adjacent parts of the Hogem Ranges, east of Takla Lake in central British Columbia (Figs. 1 and 2). The Sitlika assemblage is currently the focus of a two year 1:50,000 scale mapping project headed by one of the authors of this report (Schiarizza and Payie, 1997; Schiarizza *et al.*, 1997). This report presents U-Pb zircon geochronology for felsic volcanic and intrusive rocks, major and trace element analyses for the principal igneous lithologies of the Sitlika assemblage and Nd isotopic and rare earth analyses for rocks dated in this study.

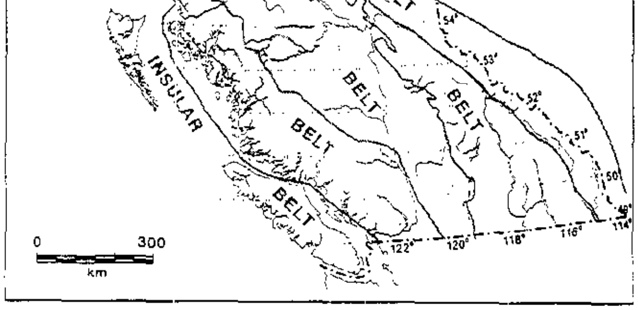

Figure 1. Location of the Sitlika assemblage, northcentral British Columbia.

PREVIOUS WORK

Volcanic and sedimentary rocks, directly east of the Takla Fault, were originally correlated with the Cache Creek Group (Armstrong, 1949). Further mapping by Paterson (1974) identified the presence of three principal lithologies within and south of the Sitlika Range: argillite, volcanic rock and greywacke. Based on the occurrence of felsic volcanic and volcaniclastic rocks within this sequence, Paterson (1974) concluded that these rocks were not part of the Cache Creek Group, and hence informally named them the Sitlika assemblage.

On the basis of similarities in lithologies and structural style Monger *et al.* (1978) suggested that the Sitlika assemblage may represent an offset portion of the Kutcho Assemblage, a fault-bounded volcano-sedimentary sequence which lies some 300 km north of the Sitlika assemblage. The Kutcho Assemblage is host to the Kutcho Creek volcanogenic massive sulphide deposit, with reserves of 17 Mt, grading 1.6% Cu and 2.3% Zn, 29 g/t Ag and 0.3 g/t Au (Bridge *et al.*, 1986); the identification of displaced slivers of the Kutcho Assemblage in the Cordillera has implications for base metal exploration. Recent studies have documented the precise age and geochemical characteristics of the Kutcho Assemblage and provide a basis for comparison between the Kutcho and Sitlika assemblages (Childe and Thompson, 1995; Thompson *et al.*, 1995; Childe and Thompson, submitted). One of the most distinctive characteristic of the Kutcho Assemblage is the Permo-Triassic to earliest Triassic age of magmatism (Childe and Thompson, submitted). This time period is typically characterized by a regional unconformity in terranes of island-arc affinity in the Cordillera (Gabrielse and Yorath, 1991).

GEOLOGY

The Sitlika assemblage comprises greenschist facies metavolcanic and metasedimentary rocks in the central part of the Intermontane Belt. They are in fault contact

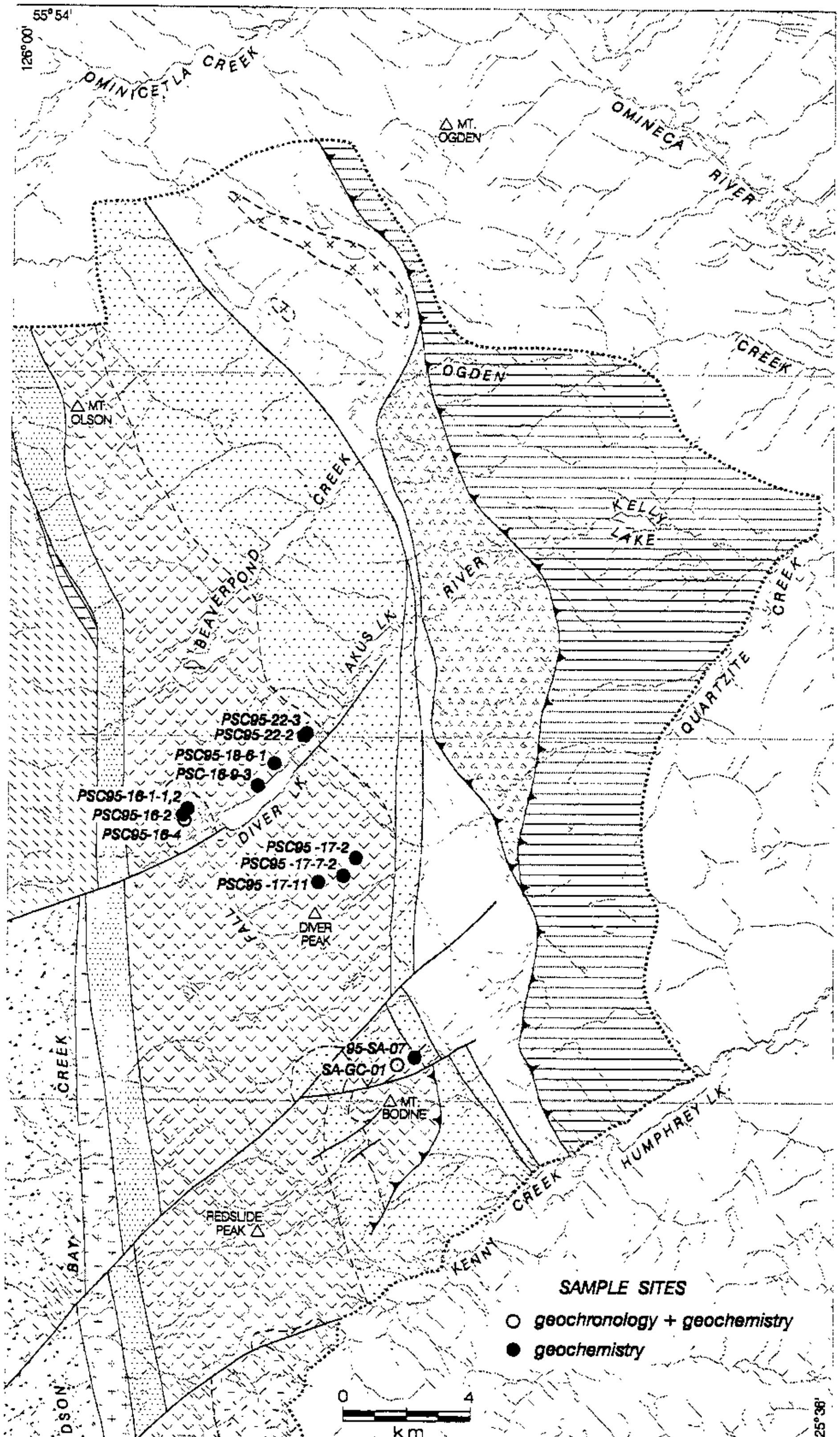

Figure 2. Generalized geology of the Kenny Creek - Mount Olson area (after Schiarizza and Payie, 1997), showing geochemistry and geochronology sample locations.

Upper Cretaceous

Sustut Group

Tango Creek Formation: polymictic conglomerate; sandstone, shale

Jurassic or Cretaceous (?)

Medium to coarse grained biotite granodiorite

STIKINE TERRANE

Lower to Middle Jurassic

Hazelton Group

Medium to dark green, brownish-weathered andesite, basalt and associated breccias and tuffs; commonly feldspar or feldspar-pyroxene-phyric; lesser amounts of volcanic conglomerate, sandstone and siltstone

Late Triassic to Early Jurassic (?)

Topley Intrusions(?): Red to pink, fine to medium-grained granite; lesser amounts of feldspar porphyry

SITLIKA ASSEMBLAGE

Middle to Upper Jurassic (?)

Western clastic unit: dark grey phyllite and slate; foliated chert-pebble conglomerate and chert-grain sandstone; lesser amounts of foliated limestone and grey phyllite containing flattened sedimentary and volcanic-lithic granules

Triassic (?)

Eastern clastic unit: variably foliated siltstone, sandstone and conglomerate containing felsic volcanic and plutonic clasts; medium to dark grey slate and phyllite; locally includes foliated limestone, limestone conglomerate and green chloritic phyllite

Early Triassic

Light grey, medium to coarse-grained tonalite; medium green, medium-grained tonalite to quartz diorite

Late Permian or Early Triassic

Medium grained epidote-chlorite-feldspar schist to semischist; sericite-chlorite-feldspar schist; weakly foliated chloritized hornblende diorite

Permian to Early Triassic

Volcanic unit: medium to dark green chlorite schist, fragmental chlorite schist and pillowed metabasalt; chlorite-sericite schist containing felsic metavolcanic fragments; lesser amounts of quartz-sericite schist, quartz-feldspar porphyry, metasandstone and metachert

CACHE CREEK TERRANE

Pennsylvanian to Triassic

Cache Creek Group

Sedimentary unit: light to medium grey quartz phyllite, platy quartzite and metachert; lesser amounts of recrystallized limestone, dark grey phyllite, massive to pillowed greenstone, fragmental greenstone and chlorite schist; minor amounts of metasandstone

Mafic unit: Medium to dark green, massive to pillowed greenstone, fragmental greenstone and chlorite schist; minor amounts of metagabbro, amphibolite, serpentinite, listwanite, slate, ribbon chert and metasandstone

Ultramafic unit: serpentinite, serpentinized ultramafite and serpentine-magnesite-talc schist; serpentinite melange containing knockers of greenstone, diabase, amphibolite, chert and limestone; locally includes mariposite-quartz-magnesite-altered rock and nephrite

Legend to accompany Figure 2.

with the Stuart Lake Belt of the Cache Creek terrane to the east, and juxtaposed against unmetamorphosed volcanic and sedimentary rocks of the Stikine terrane to the west, across the Late Cretaceous or Early Tertiary Takla fault. In the Kenny Creek - Mount Olson area, the Sitlika assemblage is subdivided into three units, corresponding to the divisions originally defined by Paterson (1974) (Fig. 2). The volcanic unit comprises mafic to felsic flow and fragmental rocks, along with comagmatic intrusions. Mafic rocks are dominant, and include thoroughly reconstituted actinolite-epidote-chlorite schists, as well as more massive greenstone with variable preservation of vesicles, plagioclase phenocrysts and pillow structures. The subordinate felsic volcanic rocks include quartz-sericite schists, with or without relict quartz and feldspar phenocrysts, as well as massive feldspar porphyry and quartz-feldspar porphyry. Light grey felsic volcanic rocks also constitute the dominant clast type in fragmental sericite-chlorite schists that are common within the unit. These fragmental rocks generally interfinger with pillowed mafic volcanic rocks, and may represent mass flow deposits derived from adjacent felsic volcanic buildups. Mafic to intermediate composition intrusive rocks within the volcanic unit include fine- to medium-grained feldspar-chlorite schist and semischist, derived from sills, dykes and small plugs of diabase, gabbro, and diorite. Felsic intrusive rocks include widespread dykes and sills of variably foliated quartz-feldspar porphyry, as well as a small multiphase tonalite stock that intrudes pillowed volcanic rocks and fragmental schist west of Diver Lake (Fig. 2).

Clastic sedimentary rocks that outcrop mainly east of the volcanic unit correspond to Paterson's (1974) greywacke division. These rocks rest stratigraphically above the volcanic unit in sections exposed north of Beaverpond Creek and west of Mount Bodine; the contact is abrupt but structurally concordant with the underlying volcanics. The basal part of the eastern clastic unit comprises conglomerate and coarse sandstone, overlain by green chloritic phyllite containing lenses of recrystallized limestone and dolostone. Conglomerates contain mainly felsic volcanic clasts, with some felsic plutonic clasts, limestone clasts and mafic volcanic clasts. The volcanic and plutonic clasts are lithologically similar to rocks found within the Sitlika volcanic unit. Higher stratigraphic levels consist mainly of dark grey slate intercalated with thin to thick, massive to graded beds of volcanic-lithic sandstone and siltstone. The eastern clastic unit is not dated, but is presumed to be Early Triassic and/or younger as it overlies the volcanic unit.

Clastic metasedimentary rocks that outcrop west of the Sitlika volcanic unit are equivalent to Paterson's (1974) argillite division, and consist of dark grey phyllite, chert-pebble conglomerate, chert-quartz sandstone, and limestone. These rocks are not well exposed, but apparently form a narrow continuous belt that occurs east of the Takla fault over the full length of the map area (Fig. 2). The contact with the adjacent Sitlika volcanic unit is not well exposed, but is inferred to be a fault. The western clastic unit is not dated, but is tentatively correlated with the Middle to Upper Jurassic

Ashman Formation at the base of the Bowser Lake Group (Tipper and Richards, 1976). This correlation is based on their general lithologic similarity, and in particular on the predominance of chert clasts in the coarser clastic intervals, which are not common in older clastic rocks found in this part of the central Intermontane Belt.

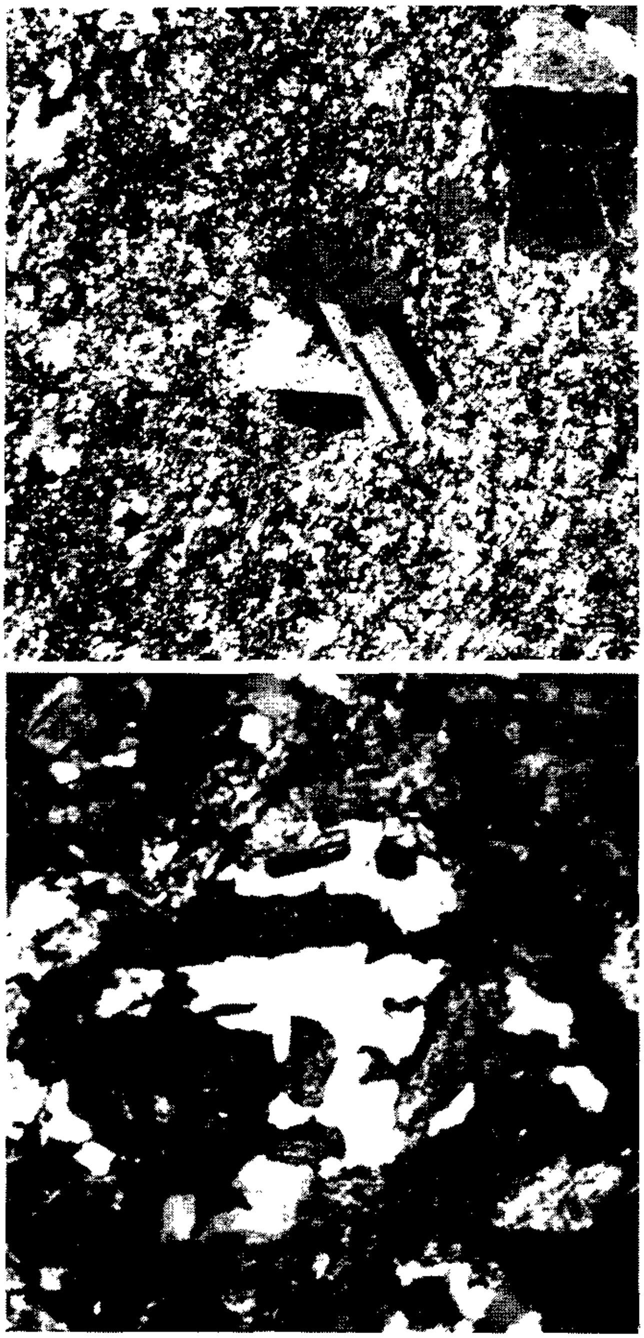

Figure 3. a-upper) photomicrograph of quartz-plagioclase glomerocryst in a quartzo-feldspathic groundmass, Mount Bodine rhyolite, sample SA-GC-01 (field of view = 5 mm); b-lower) photomicrograph of intergrown quartz and plagioclase grains, tonalite, sample PSC95-16-4 (field of view = 5 mm)

All three units of the Sitlika assemblage are characterized by a single penetrative cleavage or schistosity defined by the preferred orientation of metamorphic minerals and variably flattened clastic grains or volcanic fragments. This metamorphic foliation is axial planar to folds that are most commonly observed in the eastern clastic unit. The folds are upright, with axes that plunge north to northwest or south to southeast. North of Beaverpond Creek, the volcanic unit and lower portion of the overlying eastern clastic unit comprise a moderately east-dipping homocline cut by steeply east-dipping cleavage. Farther east, the eastern clastic unit is repeated across several upright folds. The wide outcrop expanse of the eastern clastic unit thins dramatically to the south, apparently due to truncation along the fault system that marks the Sitlika - Cache Creek contact. The volcanic belt is correspondingly wider in the south, in part due to internal folding, as indicated by a faulted anticline and adjacent syncline that repeat the volcanic unit and overlying eastern clastic unit south and west of Mount Bodine.

The Sitlika assemblage is bounded to the east by a unit of serpentinite melange that is included in the Cache Creek Group. Metasedimentary and metavolcanic rocks comprising the bulk of the Cache Creek Group farther east rest structurally above the serpentinite melange unit across an east-dipping thrust fault (Paterson, 1974). Limited structural data suggests that the Sitlika - Cache Creek contact (specifically, the contact between the Sitlika assemblage eastern clastic unit and the serpentinite melange) is a steeply dipping dextral strike-slip fault that postdates the contractional deformation within the Cache Creek Group (Schiarizza and Payie, 1997).

U-PB GEOCHRONOLOGY

Two samples were collected for U-Pb zircon geochronology. These consisted of a tonalite from the Diver Lake area, with abundant 3-6 mm glassy quartz phenocrysts set in a fine-grained crystalline groundmass (PSC95-16-4), and a rhyolite from the Mount Bodine area, with 1-2 mm quartz and plagioclase phenocrysts (SA-GC-01) (Figs. 3 a and b).

Analytical Techniques

Sample preparation and U-Pb analyses were carried out at the Geochronology Laboratory of the University of British Columbia. The samples were processed and zircon was separated using conventional crushing, grinding, Wilfley table and heavy liquid techniques. All fractions were air abraded prior to analysis, to reduce the effects of surface-correlated lead loss (Krogh, 1982). Zircon grains were selected based on criteria such as magnetic susceptibility, clarity, morphology and size. Procedures for dissolution of zircon and extraction and purification of uranium and lead follow those of Parrish *et al.* (1987). Uranium and lead were loaded onto single, degassed refined rhenium filaments using the silica gel and phosphoric acid emitter technique. Procedural blanks were 9 and 6 picograms for lead and uranium, respectively. Errors assigned to individual analyses were calculated using the numerical error propagation method

TABLE 1. U-PB ZIRCON ANALYTICAL DATA

Fraction[1]	Wt.	U	Pb[2]	$^{206}Pb/^{204}Pb$ [3]	Pb[4]	^{208}Pb [5]	Isotopic ratios($\pm 1\sigma$,%)[6]			Isotopic dates(Ma,$\pm 2\sigma$)[6]		
	mg	ppm	ppm		pg	%	$^{206}Pb/^{238}U$	$^{207}Pb/^{235}U$	$^{207}Pb/^{206}Pb$	$^{206}Pb/^{238}U$	$^{207}Pb/^{235}U$	$^{207}Pb/^{206}Pb$
Mount Bodine rhyolite SA-GC-01												
A,m,M1,p	0.120	77	3	1730	14	9.7	0.04082±0.13	0.2892±0.29	0.05138±0.23	257.9±0.7	257.9±1.3	257.8±10.5
B,f,M1,p	0.122	60	2	604	29	8.9	0.03680±0.13	0.2603±0.43	0.05129±0.34	233.0±0.6	234.9±1.8	253.9±15.7
C,f,M1,p	0.102	53	2	917	14	8.1	0.03782±0.12	0.2671±0.35	0.05123±0.28	239.3±0.6	240.4±1.5	251.0±12.7
J,f,M2,p	0.052	67	2	579	15	8.5	0.03714±0.14	0.2632±0.48	0.05140±0.40	235.1±0.7	237.2±2.0	258.7±18.2
Diver Lake tonalite PSC95-16-4												
A,c,N1,p	0.099	194	7	2469	19	7.8	0.03801±0.22	0.2682±0.31	0.05112±0.19	240.5±1.0	241.2±1.3	248.8±8.3
B,c,N21p	0.035	174	7	1254	12	8.6	0.03807±0.18	0.2689±0.40	0.05122±0.32	240.9±0.8	241.8±1.7	250.9±14.6
C,m,N1,p	0.140	244	9	4202	19	7.7	0.03771±0.11	0.2652±0.21	0.05100±0.13	238.6±0.8	238.8±0.9	240.7±5.9
D,c,M1,p	0.285	230	37	6801	23	8.1	0.03816±0.12	0.2689±0.21	0.05111±0.11	241.4±0.6	241.8±0.9	245.7±5.0
E,c,N1,p	0.196	199	32	3925	24	7.5	0.03816±0.10	0.2686±0.21	0.05105±0.13	241.4±0.5	241.6±0.9	243.0±6.2

[1]All fractions are air abraded; Grain size, smallest dimension: c= +134μm, m=-134μm+74μm, f=-74μm;
Magnetic codes: Franz magnetic separator sideslope at which grains are nonmagnetic; e.g., N1=nonmagnetic at 1°; Field strength for all fractions =1.8A; Front slope for all fractions=20°; Grain character codes: p=prismatic.
[2]Radiogenic Pb
[3]Measured ratio corrected for spike and Pb fractionation of 0.0043/amu ±20% (Daly collector)
[4]Total common Pb in analysis based on blank isotopic composition
[5]Radiogenic Pb
[6]Corrected for blank Pb, U and common Pb (Stacey-Kramers model Pb composition at the $^{207}Pb/^{206}Pb$ date of fraction, or age of sample).

of Roddick (1987) and all errors are quoted at the 2σ level. Ages were calculated using the decay constants recommended by Steiger and Jäger (1977). Common lead corrections were made using the two-stage growth model of Stacey and Kramers (1975). Discordia lines were regressed using a modified York-II model (York, 1969; Parrish et al., 1987). Uranium-lead analytical results are presented in Table 1.

Analytical Results

The Diver Lake tonalite (PSC95-16-4) contained abundant coarse-grained, prismatic zircon with few inclusions and good clarity. Analysis of five fractions yielded $^{207}Pb/^{206}Pb$ ages of 241 to 251 Ma. Fraction E was concordant with a $^{206}Pb/^{238}U$ age of 241.4 Ma, while fraction D slightly overlapped concordia, with a $^{206}Pb/^{238}U$ age of 241.4 Ma (Figure 4a). An Early Triassic age of 241 +/-1 Ma, which is based on the $^{206}Pb/^{238}U$ age and associated errors of fractions E and D, is considered to be the best estimate for the age of this rock.

The Mount Bodine rhyolite (SA-GC-01) contained a small quantity of fine-grained prismatic zircon with few inclusions and good clarity. Zircon from this rock was characterized by extremely low U concentrations (53 to 77 ppm), which is in part reflected in low $^{206}Pb/^{204}Pb$ ratios (Table 1). All of the zircon recovered from this rock was divided into four fractions, analyses yielded $^{207}Pb/^{206}Pb$ ages of 251 to 259 Ma. Fraction A was concordant, with a $^{206}Pb/^{238}U$ age of 257.9 Ma (Figure 4b). A Permian age of 258 +10/-1 Ma based on the $^{206}Pb/^{238}U$ age and $^{206}Pb/^{238}U$ and $^{207}Pb/^{206}Pb$ errors of fraction A, is considered to be the best estimate of the age of this rock.

GEOCHEMISTRY

Major and Trace Elements

A suite of thirteen igneous rock samples from the Sitlika assemblage were analyzed for major and trace element abundances. Based on these analyses, the Sitlika assemblage has a roughly bimodal distribution of compositions, containing basalt (47-50% SiO_2) and dacite to rhyolite, and their intrusive equivalents (62-85% SiO_2) (Table 2). The Mount Bodine rhyolite (SA-GC-01) has a high SiO_2 concentration (85%), combined with relatively low concentrations of other major elements (Al_2O_3, Fe_2O_3, CaO, Na_2O) which indicates silicification of this rock, and is consistent with field observations. In a plot of SiO_2 vs. K_2O (Pecerrillo and Taylor, 1976), unaltered rocks from the Sitlika

Table 2. Major and trace element data.

sample number	lithology	SiO_2 %	TiO_2 %	Al_2O_3 %	Fe_2O_3 %	MnO %	MgO %	CaO %	Na_2O %	K_2O %	P_2O_5 %	LOI	Total	BaO ppm
SA-GC-01	rhyolite	85.25	0.16	8.40	1.58	0.02	0.00	0.15	4.53	0.23	0.02	0.25	100.59	<d/l
95-SA-07	dacite	67.86	0.70	11.37	5.93	0.26	2.46	0.44	3.04	0.55	0.19	4.35	100.31	103
PSC95-16-1-1	tonalite	74.47	0.30	13.45	2.55	0.05	0.65	1.95	5.09	0.69	0.06	0.99	100.28	181
PSC95-16-1-2	QFP	66.42	0.65	16.01	4.72	0.11	1.35	3.66	5.56	0.30	0.18	1.34	100.33	170
PSC95-16-2	QFP to tonalite	65.18	0.74	16.12	5.17	0.10	1.56	3.72	5.34	0.34	0.18	1.82	100.30	116
PSC95-16-4	tonalite	74.43	0.31	13.92	2.09	0.03	0.71	2.45	5.16	0.62	0.06	0.87	100.69	258
PSC95-16-9-3	pillowed metabasalt	49.00	2.17	16.40	12.62	0.19	4.79	5.08	5.38	0.04	0.24	3.85	99.85	191
PSC95-17-2	biot-chl. schist	48.53	1.81	14.64	15.65	0.24	5.56	6.37	3.79	0.45	0.11	3.42	100.67	257
PSC95-17-7-2	chlorite schist	62.09	1.38	15.02	8.18	0.17	2.53	2.68	7.23	0.18	0.20	0.98	100.68	132
PSC95-17-11	chlorite schist	46.98	1.53	16.15	12.36	0.19	5.04	9.05	4.24	0.07	0.28	4.70	100.67	135
PSC95-18-6-1	pillowed metabasalt	49.89	1.42	15.64	13.91	0.22	4.92	7.70	4.38	0.12	0.14	2.56	100.98	138
PSC95-22-2	chl-ser-qtz schist	74.14	0.12	14.68	1.29	0.04	0.35	0.31	7.05	1.28	0.02	0.82	100.13	125
PSC95-22-3	chlorite schist	43.91	1.35	17.13	11.78	0.18	6.84	7.89	4.20	0.22	0.18	6.68	100.46	119
Detection Limits (ppm):		60	35	120	30	30	95	15	75	25	35			17

sample number	Co ppm	Cr_2O_3 ppm	Cu ppm	Ni ppm	V ppm	Zn ppm	Ga ppm	Nb ppm	Pb ppm	Rb ppm	Sr ppm	Th ppm	U ppm	Y ppm	Zr ppm
SA-GC-01	47	<d/l	7	<d/l	<d/l	68	9.8	5.3	<d/l	<d/l	23.1	<d/l	<d/l	40.0	180.3
95-SA-07	18	<d/l	83	<d/l	83	1219	19.0	3.3	160.9	4.6	35.6	<d/l	<d/l	50.2	166.0
PSC95-16-1-1	54	<d/l	5	<d/l	25	57	13.9	4.1	<d/l	8.8	132.5	<d/l	4.3	27.4	139.3
PSC95-16-1-2	36	<d/l	4	<d/l	56	60	16.6	3.9	<d/l	2.7	200.2	<d/l	4.5	40.4	131.0
PSC95-16-2	14	<d/l	3	<d/l	68	59	15.0	4.1	<d/l	3.9	217.0	<d/l	4.4	42.7	117.8
PSC95-16-4	60	<d/l	4	<d/l	27	43	13.7	3.9	<d/l	5.4	110.9	<d/l	4.2	29.4	127.3
PSC95-16-9-3	44	66	46	11	402	136	20.1	3.6	2.3	<d/l	106.4	4.2	6.7	43.6	121.1
PSC95-17-2	45	35	32	<d/l	490	117	18.1	3.4	2.1	5.7	118.9	5.1	7.1	30.6	46.5
PSC95-17-7-2	19	<d/l	12	<d/l	164	111	19.5	4.0	1.0	1.0	73.9	1.3	5.8	53.2	268.1
PSC95-17-11	37	217	27	45	253	118	18.0	2.8	1.8	<d/l	133.2	4.0	6.6	37.6	109.9
PSC95-18-6-1	37	<d/l	53	3	391	126	19.2	3.0	1.6	<d/l	125.0	4.7	7.0	37.4	106.6
PSC95-22-2	30	<d/l	23	9	<d/l	60	17.2	8.2	<d/l	8.5	25.6	<d/l	4.0	85.5	233.7
PSC95-22-3	47	271	89	62	288	124	14.9	3.8	1.9	2.6	73.5	3.0	6.6	28.0	74.6
Detection Limits (ppm):	10	15	2	3	10	2	1	1	1	1	1	1	1	1	1

Table 3. Rare earth element data.

sample number	Au ppb	Ag ppm	As ppm	Br ppm	Cs ppm	Hf ppm	Hg ppm	Ir ppb	Sb ppm	Sc ppm	Se ppm	Ta ppm	W ppm	La ppm	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm
SA-GC-01	<d/l	<d/l	<d/l	<d/l	<d/l	<d/l	<d/l	<d/l	0.1	6.4	<d/l	1.4	251	6.6	23	16	4.4	0.8	1.0	4.4	0.6
PSC95-16-4	<d/l	<d/l	<d/l	<d/l	<d/l	4.5	<d/l	<d/l	0.6	6.1	0.8	1.6	302	5.8	<d/l	16	2.3	0.9	0.6	3.1	0.5
PSC95-18-6-1	<d/l	<d/l	2.0	<d/l	<d/l	2.9	<d/l	<d/l	0.6	39.1	<d/l	<d/l	15	4.3	<d/l	16	3.6	1.4	0.9	3.6	0.5
Detection	2	2	1	0.5	0.2	0.2	1	1	0.1	0.1	0.5	0.3	1	0.1	1	1	0.01	0.05	0.1	0.05	0.01
Limits:	ppb	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm

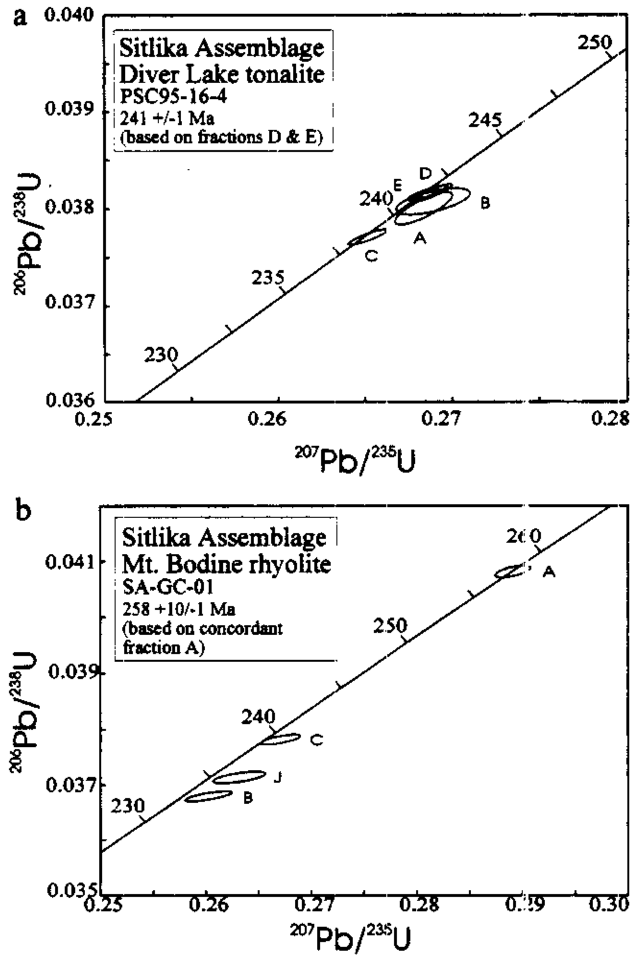

Figure 4. U-Pb concordia diagrams for a) Diver Lake tonalite (PSC95-16-4); and b) Mount Bodine rhyolite (SA-GC-01).

assemblage lie within the field for low-K magmas (Fig. 5a).

A plot of Zr vs. Y indicates that intrusive and volcanic rocks of the Sitlika assemblage have a predominantly tholeiitic magmatic affinity, with Zr/Y ratios of 1.5 to 5.0 (Fig. 5b and Table 3).

Rare Earth Elements

Rare earth element (REE) concentrations were determined for samples of rhyolite, tonalite, and basalt from the Sitlika Assemblage (Table 4 and Figure 6a and b). All three rocks are characterized by low REE abundances and near-flat REE patterns. A small negative europium anomaly for the rhyolite is consistent with fractionation of plagioclase in this unit. With the exception of the europium anomaly, the patterns for the rhyolite and tonalite are extremely similar (Figure 6a). The low overall REE concentrations and near-flat REE patterns for rocks of the Sitlika Assemblage suggest derivation from primitive magmatic sources.

Table 4. Nd Isotopic Data

Sample	Sm (ppm)	Nd (ppm)	$^{147}Sm/^{144}Nd$	meas. $^{143}Nd/^{144}Nd$ (error x 10^{-6}, 2σ)	ε_{Nd}[2] (present day)	age[1] (Ma)	ε_{Nd}[2] (initial)
Mount Bodine rhyolite SA-GC-01	4.77	16.12	0.1789	0.513029 (6)	+7.6	258	+8.2
Diver Lake tonalite PSC95-16-4	2.61	9.99	0.16158	0.512723 (19)	+1.7	241	+2.7

[1]used for the calculation of ε_{Nd} (initial).
[2]error = $\pm$0.5 ε_{Nd} units.

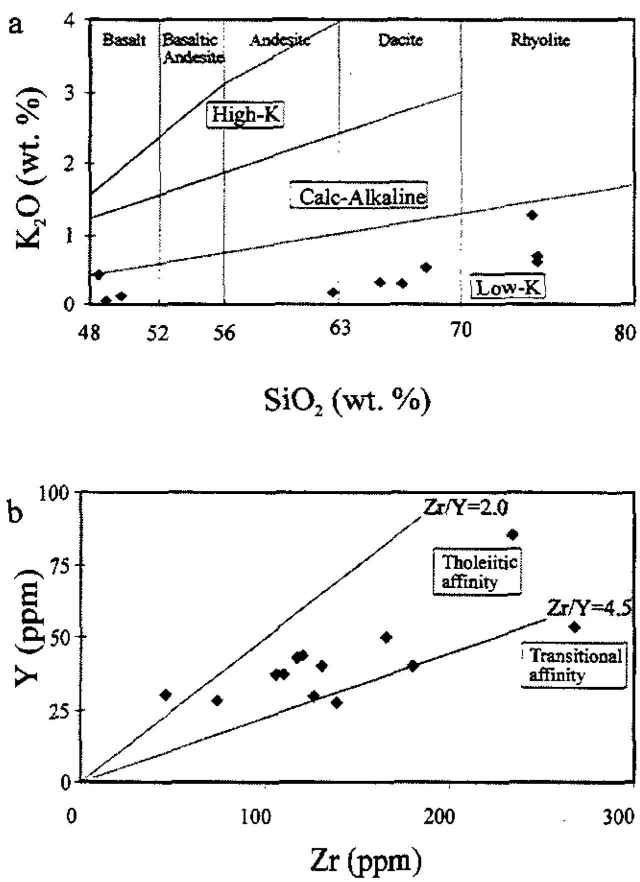

Figure 5. a) SiO_2 vs. K_2O diagram for unaltered rocks of the Sitlika Assemblage (fields from Peccerillo and Taylor, 1976); b) Zr vs. Y diagram for all samples from the Sitlika Assemblage (fields from Barrett and MacLean, 1994).

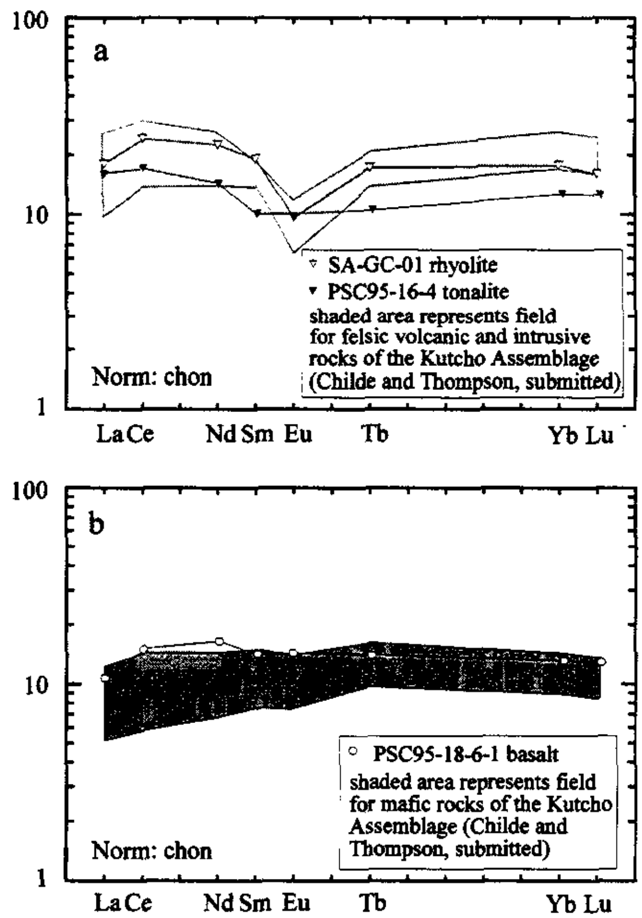

Figure 6. Chondorite-normalized rare earth element diagram for a) rhyolite (SA-GC-01) and tonalite (PSC95-16-4), showing the field for felsic volcanic and intrusive rocks of the Kutcho Assemblage (Childe and Thompson, submitted), and b) basalt (PSC95-18-6-1) from the Sitlika Assemblage, showing the field for mafic volcanic rocks of the Kutcho Assemblage (Childe and Thompson, submitted).

ND ISOTOPIC SYSTEMATICS

The Nd isotopic ratio of rhyolite and tonalite dated in this study were determined to further constrain the degree of evolution of this magma. Isotopic analysis of the rhyolite was conducted by R. Thériault at the Geochronology Laboratory of the Geological Survey of Canada; analysis of the tonalite was conducted at Memorial University. Analytical procedures are described by Thériault (1990). Abundances of Sm and Nd determined by isotope dilution have an uncertainty of 1% or less. Uncertainty for calculated ε_{Nd} values is $\pm$0.5 ε_{Nd} units. Neodymium analytical results are presented in Table 4.

An initial ε_{Nd} value of +8.2 for the Mount Bodine rhyolite is one of the highest values reported for a felsic rock within the Cordillera and indicates derivation of this magma from primitive, unenriched magmatic sources, with no evidence for contamination by old, isotopically evolved sialic crust. An initial ε_{Nd} value of +2.7 for tonalite that intrudes the Sitlika assemblage indicates that this unit is also derived from primitive magmatic sources.

DISCUSSION

Ages of 258 +10/-1 Ma and 241 +/-1 Ma, determined for rhyolite and tonalite, respectively, indicate that magmatic activity in the Sitlika assemblage was occurring in the Permo-Triassic, and in part overlapped in time with magmatism in the Kutcho Assemblage. Major and trace element chemistry shows that the Sitlika assemblage is composed of low-K intrusive and bimodal volcanic rocks with a tholeiitic magmatic affinity. Rare earth element chemistry and Nd isotopic systematics indicate derivation from primitive magmas, uncontaminated by old, evolved crust.

Rocks of the Sitlika assemblage formed in the same time period as the Kutcho Assemblage, and the principal lithologies are indistinguishable from those of the Kutcho Assemblage. As such, this region represents a viable exploration target for Kutcho Creek-equivalent VMS mineralization in the Cordillera.

ACKNOWLEDGMENTS

The authors wish to thank J.M. Marr (Agate Bay Resources Ltd.) for sharing his ideas and observations on the Sitlika assemblage and D. Bohme (Inco Ltd.) for providing an introduction to the Sitlika assemblage. The staff of the UBC Geochronology Laboratory are thanked for their assistance. R. Friedman, J.F.H. Thompson and W.J. McMillan provided helpful reviews of this manuscript. V. Vilkos prepared figures 1 and 2. R. Thériault (Geological Survey of Canada) is acknowledged for the Nd isotopic analysis of rhyolite from the Sitlika assemblage.

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