GEOLOGICAL SURVEY OF CANADA

OPEN FILE 3905

Tourmaline occurrences in the northern Taltson magmatic zone

H.H. Bostock

2000

GEOLOGICAL SURVEY OF CANADA

OPEN FILE 3905

Tourmaline occurrences in the northern Taltson magmatic zone

H.H. Bostock

2000

TOURMALINE OCCURRENCES IN THE NORTHERN TALTSON MAGMATIC ZONE

Open File Number 3905

H. H. BOSTOCK, May 1st, 2000

ABSTRACT

Tourmaline occurrences within exposed northern Taltson magmatic zone (TMZ) are described in table and map form giving the UTM coordinates of 213 sites. Two settings, granitoid and partly remobilized syngenetic metasedimentary, are involved. The latter outlines a tourmaline trajectory that crosses exposed TMZ from southeast to northwest between the 60th parallel in the south and the Great Slave Lake shear zone in the north.

INTRODUCTION

In the course of field reconnaissance and related early petrographic studies of the exposed northern Taltson magmatic zone (TMZ) between Great Slave Lake shear zone and the Alberta border (60 degrees N latitude) it became evident that tourmaline is present in some parts of this area and not in others (Bostock, 1990). This early work also suggested that much of the tourmaline was deposited under stratigraphic control and in part subsequently remobilized in a manner suggested by the pioneering work of Slack (1982) and Slack et al., (1984). Because of tourmaline's potential as a regional, target indicator in the exploration for several types of ore deposit, the current report has been assembled to release additional data collected in part from subsequent field work, but

mostly from the discovery of additional tourmaline occurrences through thin section study.

GEOLOGICAL SETTING

The Paleoproterozoic Taltson magmatic zone (TMZ) comprises the southern continuation of the Thelon-Taltson orogen at the west margin of the Rae Province, Canada. Earliest Proterozoic granitoid plutonism (2.45-2.27 Ma) along this margin was followed by deposition of pelitic to psammitic sediments with local amphibolite units in the Rutledge River rift basin (2.3-2.1 Ma; Bostock and van Breemen, 1994). These sediments were intruded south of the Great Slave Lake shear zone by the plutons of Taltson magmatic zone mostly in the interval 2.00-1.90 Ga. The tourmaline concerned is thought to have been in large part syngenetically deposited in the Rutledge River basin and subsequently extensively remobilized during Taltson magmatism.

TOURMALINE DATA

A list of the tourmaline occurrences discovered within the northern TMZ together with their locations (UTM coordinates for zone 12) and brief descriptive data is presented in Table 1. The data were derived from direct observation in the field and from the examination of over 3000 thin sections more or less representative of the entire map area. The positions of these occurrences are shown in Fig. 1.

Concentrations of tourmaline occurrences occur in two parts of northern TMZ: One, involving the majority of occurrences, is found in sedimentary rocks, veins and granitoid rocks that form a discontinuous band or trajectory crossing the northern TMZ from southeast to northwest. The larger gaps in the trajectory are outlined by major faults (Fig. 1). The other part, within and immediately south of the Gagnon granite in the northeastern corner of northern TMZ, consists of tourmaline in pegmatite, in Gagnon granite, in small bodies of granitoid, and rarely in granitiod gneiss of unknown origin.

Four isolated single occurrences associated with minor granitoid rocks have been encountered within the west central Deskenatlata pluton, within Great Slave Lake shear zone, near the northeastern extremity of TMZ and in the southern part of northern TMZ along the 111th meridian.

The tourmaline found in trajectory occurrences is predominantly disseminated in trace amounts as minute grains in metasediments ranging from granulite facies paragneiss within TMZ to greenschist facies mudstone and greywacke along its eastern margin. Locally a higher concentration of tourmaline is attained (Table 1, Fig. 1). In particular a single layer of tourmalinite some 30 cm wide, composed of about 60 per cent tourmaline, 20 per cent biotite and 20 per cent corundum, was found as a component of a large paragneiss raft within the Konth granite (Fig. 1). A second occurrence of probable syngenetic origin was found as diseminated

grains in a sample of paragneiss bearing a cm scale band of minute scheelite grains (confirmed by fluorescence in ultraviolet light). Other occurrences developed as epigenetic tourmaline-bearing quartz and granitic veins which cut paragneiss or granite, and as tourmaline dissemination's in granite.

The distribution of vein- and granite-hosted tourmaline occurrences within the tourmaline trajectory is peculiar. Where the trajectory lies outside the Konth granite tourmaline-bearing veins and dykes are intermingled with tourmaline occurrences in paragneiss. Within Konth granite however, the occurrences of syngenetic tourmaline within paragneiss are lined up with the southern limit of the trajectory whereas tourmaline-bearing dykes and veins form a diffuse halo along the northern margin of the trajectory (Fig. 1).

DISCUSSION

Two problematic aspects of the tourmaline trajectory are potentially significant in its consideration as a target zone for mining exploration in the northern TMZ. These involve the asymmetry of syngenetic versus epigenetic tourmaline occurrences within Konth batholith; and the question as to whether one or more than one age of tourmaline deposition was involved (Is the tourmaline trajectory reflecting a regional, pre-Taltson, crustal structure; or is it symptomatic of more than one distinct episode of fortuitously sited local mineralization?).

The asymmetry of syngenetic versus epigenetic tourmaline occurrences within the Konth batholith is consistent with the view that the tourmaline-bearing beds in the Rutledge River basin (now preserved as rafts in the granite) have a northward plunge. Remobilization of their constituent boron in the high temperature environment that obtained immediately after emplacement of the granite (peak T approximately 1920-1045^{o}C at 6.9±0.9kb, Berman and Bostock, 1997) resulted in upward migration of boron-bearing residual fluids. This view is consistent with the northward increasing magnitude of the negative total field magnetic anomaly centered on the Konth granite which may represent a northward increasing thickness of preserved granite.

At the east margin of southern TMZ near the northern Alberta border, a significant concentration of syngenetic to epigenetic tourmaline occurrences has been described in association with the low grade metasediments of the Waugh Lake Group (Watanabe, 1961; McNicoll and McDonough,1995). The latter authors have dated the period of Waugh Lake sedimentation between 2008 and 1971 Ma., whereas Bostock and van Breemen (1994) suggest an earlier cessation of deposition in the Rutledge River basin at between 2.13 and 1.09 Ga. The greenschist facies metasediments in the Hill Island Lake area at the southeastern end of the tourmaline trajectory (north of 60^{o} N) are preserved in a graben-like structure, and time constraints for their deposition (2.3 Ga to 1.94 Ga; Bostock and van Breemen, 1994) allow a younger age for their deposition than has been suggested for the Rutledge paragneiss within the TMZ.

Accordingly, the Rutledge River basin and the Waugh Lake-Hill Island Lake basins, with their respective syngenetic tourmaline occurrences, might be of distinct ages.

On the other hand, additional regional evidence of the critical metamorphism at Rutledge Lake, used to date collapse of the Rutledge River basin, has not been found elsewhere. Moreover, no detrital or intrusive zircon or monazite ages have been found in exposed northern TMZ in the interval between 2050 and 1986 Ma. This would allow that the Rutledge metamorphic event was a local one, and that deposition in the Rutledge River basin may have continued perhaps until intrusion of the Deskenatlata granodiorite at 1986 Ma (Bostock et al., 1987). In this case the zircon-monazite data from the Rutledge Lake area (representing the Mama Moose complex of Culshaw, 1984) would constrain deposition in a local Mama Moose basin to the period before 2.91-2.09 Ga; whereas deposition of the Rutledge River paragneiss, representing the more widely distributed sediments in which the tourmaline trajectory was formed, is not constrained till 1.99 Ga and could have included deposition within the Waugh Lake basin. This suggestion must be qualified by the observations of Culshaw (1984) who reported that the Mama Moose paragneiss, unlike the Rutledge Lake paragneiss, is not generally intimately interlayered with granite and does not contain certain small mafic-ultramafic bodies. His hypotheses are that the Mama Moose complex may be either younger than the more extensive paragneiss-bearing Rutledge Lake complex or allochthonous.

REFERENCES

Berman, R.G. and Bostock, H.H.

1997: Metamorphism in the northern Taltson magmatic zone, Canada; Canadian Mineralogist, v. 35, p. 1069-1092.

Bostock, H.H.

1990: A preliminary report on the distribution of tourmaline in the northern Taltson Magmatic Zone, Northwest Territories, and its implication for base metal and tungsten prospecting; in Current Research, part C; Paper 90-1C; Geological Survey of Canada; p. 31-

Bostock, H.H. and van Breemen, O.

1994: Ages of detrital and metamorphic zircons from a pre-Taltson magmatic zone basin at the western margin of Churchill Province; Canadian Journal of Earth Sciences; v. 31, p. 1353-1364.

Bostock, H.H., van Breemen, O. and Loveridge, W.D.

1987: Proterozoic geochronology in the Taltson Magmatic Zone, N.W.T.; in Radiogenic Age and Isotopic Studies: Report 1, Geological Survey of Canada, v. Paper 87-2, p. 73-80.

Culshaw, N.G.

1984: Rutledge Lake, Northwest Territories; a section across a shear belt within the Churchill Province: in Current Research, Part A, Geological Survey of Canada, Paper 84-1A, p. 331-338.

McNicoll, V.J. and McDonough, M.R.

1995: The Waugh Lake Basin: a 2.01-1.971 Ga Back Arc Basin, Southern Taltson Magmatic Zone, Northeastern Alberta. Contribution to Canada-Alberta Partnership on Minerals, 1992-1995 (from Preprint), p 1-10.

Slack, J.F.

1982: Tourmaline in Appalachian-Caledonian massive sulfide deposits and its exploration significance; Institution of Mining and Metallurgy, Transactions vol. 91, section B, p B81-B89.

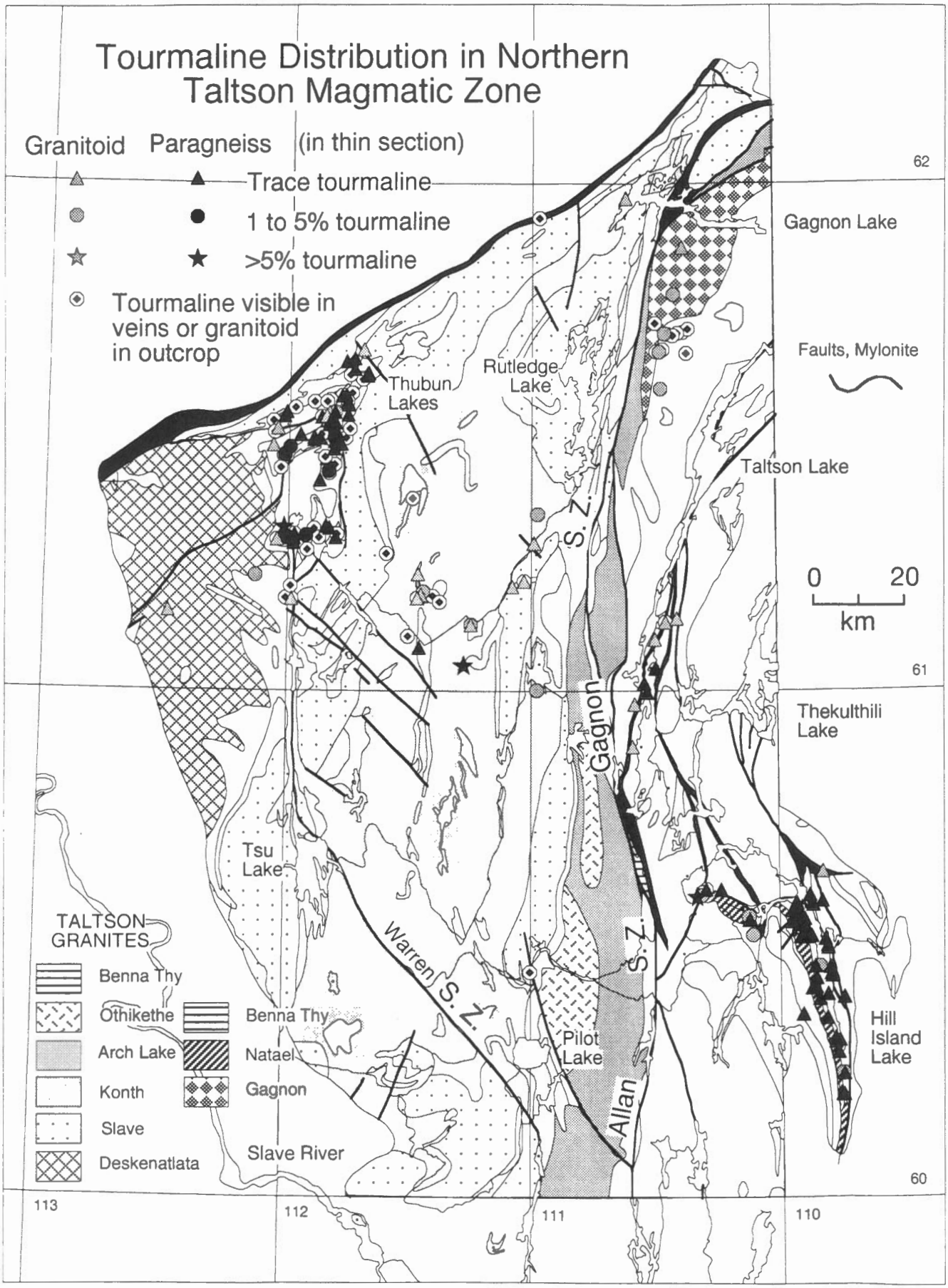
Slack, J.F., Herriman, N., Barnes, R.G., and Plimer, I.R.

1984: Stratiform tourmalinites in metamorphic terranes and their geologic significance; Geology, vol. 12, p. 713-716.

Watanabe, R.Y.

1961: Geology of the Waugh Lake metasedimentary complex, northeastern Alberta; Master of Science thesis, University of Alberta, p. 1-89.

LIST OF COMPONENTS


Tourmaline Distribution in Northern Taltson Magmatic Zone
Granitoid
Paragneiss (in thin section)
Trace tourmaline
1 to 5% tourmaline
>5% tourmaline
Tourmaline visible in veins or granitoid in outcrop
Faults, Mylonite
0 20
km
Gagnon Lake
Thubun Lakes
Rutledge Lake
Taltson Lake
S. Z.
Gagnon
Thekulthili Lake
Tsu Lake
Warren S. Z.
Pilot Lake
Allan
Hill Island Lake
Slave River
TALTSON GRANITES
Benna Thy
Othikethe
Arch Lake
Konth
Slave
Deskenatlata
Benna Thy
Natael
Gagnon
62
61
60
113
112
111
110

TOURMALINE DATA TABLE

SMPL/STN	TYPE	EASTING	NORTHING	TOURMALINE
87BB-019	17	464270	6832620	vis
87BK-038	17	454960	6813950	vis
87BK-05	17	464000	6832380	vis
87BKO-0064	17	454900	6820790	vis
87BKO-0065	17	454180	6820610	vis
91BK-618	17	569000	6674430	vis
85BK-104	21	529520	6777770	vis
85BKK-255	21	447800	6797450	vis
85BKK-255	21	447800	6797450	vis
87BKO-0002	21	462840	6831500	vis
87BKO-0071	21	453780	6819180	vis
85BKJ-211	22	476820	6783510	vis
85BKK-301	22	444750	6812000	vis
86BK-772	22	538020	6718390	vis
87BK-094	22	455090	6826390	vis
87BK-120	22	443230	6822320	vis
87BKO-410	22	528600	6837570	vis
87BKO-412	22	527880	6837120	vis
87BKO-415	22	530800	6840690	vis
88K-452	22	498380	6786740	vis
85BJK-209	23	476250	6784530	vis
85BKJ-214	23	478400	6783500	vis
85BKJ-220	23	475000	6783110	vis
88BK-380	23	473990	6805030	vis
87BKO-396	25	529540	6841030	vis
87BKO-430	25	528960	6841150	vis
83BKJ-657	26	472930	6774700	vis
85BKJ-370	26	452070	6798600	vis
85BKJ-444	26	443910	6796350	vis
85BKJ-447	26	445810	6796610	vis
85BKJ-448	26	446200	6796760	vis
85BKK-129	26	450600	6794000	vis
85BKK-255	26	447800	6797450	vis
85BKK-255	26	447800	6797450	vis
86BK-714	26	528190	6829010	vis
86BK-769	26	538620	6719030	vis
86BK-773	26	537790	6718320	vis
86BK-775	26	537560	6717750	vis
86BKL-146	26	456570	6817600	vis
86BKL-149	26	456850	6818300	vis
86BKL-166	26	456750	6812500	vis
86BKL-170	26	455500	6810700	vis
86BKL-255	26	468120	6792980	vis
86BKM-290	26	486590	6777210	vis
87BK-01	26	463040	6831240	vis

TOURMALINE DATA TABLE

SMPL/STN	TYPE	EASTING	NORTHING	TOURMALINE
87BK-040	26	454670	6814230	vis
87BK-061	26	456910	6821800	vis
87BK-141	26	443480	6819840	vis
87BK-151	26	460140	6820370	vis
87BK-154	26	460270	6832220	vis
87BKO-0031	26	455800	6826760	vis
87BKO-0036	26	453890	6823080	vis
87BKO-0047	26	460600	6828210	vis
87BKO-404	26	526910	6843470	vis
87BKO-413	26	527180	6837230	vis
87BKO-417	26	533780	6836860	vis
88BK-165	26	499810	6700790	vis
88BK-513	26	447080	6783210	vis
88BK-530	26	446920	6786010	vis
87BKO-0021	28	458390	6827730	vis
85BKJ-235	48	479950	6782270	vis
85BKJ-242	48	457270	6797320	vis
85BKJ-355	48	453230	6796600	vis
85BKJ-445	48	444920	6796190	vis
85BKJ-446	48	445410	6796030	vis
86BKL-104	48	459220	6818400	vis
86BKL-138	48	457220	6816800	vis
86BKL-139	48	457300	6816900	vis
86BKL-145	48	456770	6817570	vis
86BKM-054	48	501310	6801410	vis
87BK-089	48	452290	6826390	vis
87BK-101	48	448110	6825200	vis
87BKO-0050	48	459600	6826400	vis
87BKO-0063	48	455530	6821400	vis
87BKO-0380	48	534120	6842110	vis
87BKO-207	48	501500	6866450	vis
87BKO-379	48	532970	6841460	vis
87BKO-390	48	531780	6841220	vis
88BK-516	48	445790	6783460	vis
83BK-167A	12	566060	6701070	1
83BK-176A	12	564800	6708600	1
83BK-179A	12	565320	6707220	1
83BK-23B	12	568980	6695900	1
83BK-302A	12	564120	6716930	1
83BK-307A	12	562100	6715980	1
83BK-323A	12	561420	6718140	1
83BK-36A	12	565400	6706670	1
83BK-42A	12	565910	6702490	1
83BK-48A	12	566300	6700560	1
81BK-652A	13	548210	6712510	1

TOURMALINE DATA TABLE

SMPL/STN	TYPE	EASTING	NORTHING	TOURMALINE
81BK-653A	13	548110	6712360	1
81BKF-163A	13	557560	6714590	1
81BKF-164A	13	558350	6714620	1
81BKF-164C	13	558350	6714620	1
83BK-155A	13	568020	6686510	1
83BK-174A	13	565360	6696530	1
83BK-185A	13	561400	6709180	1
83BK-186A	13	560810	6708860	1
83BK-187A	13	559440	6708870	1
83BK-19A	13	562900	6699980	1
83BK-268A	13	560270	6712890	1
83BK-274A	13	561780	6709240	1
83BK-278A	13	560730	6710800	1
83BK-2A	13	563630	6695430	1
83BK-405A	13	559650	6713140	1
83BK-407A	13	558990	6711480	1
83BK-407B	13	558990	6711480	1
83BK-418B	13	557570	6712240	1
83BK-419A	13	558120	6712400	1
83BK-438A	13	558670	6716260	1
83BK-441A	13	559580	6713670	1
83BK-442A	13	559080	6713720	1
83BK-445A	13	558280	6716000	1
83BK-97A	13	562620	6702600	1
83BKJ-109A	13	562800	6697990	1
83BKJ-111A	13	561930	6697800	1
83BKJ-21B	13	565310	6691380	1
83BKJ-46A	13	567080	6686150	1
83BKJ-76A	13	567100	6686990	1
83BKJ-77A	13	567810	6683780	1
86BK-769C	13	538620	6719030	1
81BKH-435A	17	541900	6719000	1
83BKJ-35A	17	560040	6692080	1
83BKJ-575A	17	475400	6772200	1
85BK-27A	17	527370	6767650	1
85BKJ-219B	17	475800	6783810	1
85BKJ-295C	17	453440	6809210	1
85BKJ-303A	17	456950	6796630	1
85BKJ-86B	17	524820	6764380	1
85BKJ-89B	17	525450	6762400	1
85BKK-1A	17	455500	6798700	1
85BKK-255A	17	447800	6797450	1
85BKK-256A	17	447750	6796600	1
85BKK-257A	17	447600	6795600	1
85BKK-3A	17	454700	6799100	1

TOURMALINE DATA TABLE

SMPL/STN	TYPE	EASTING	NORTHING	TOURMALINE
85BKL-133A	17	458200	6817000	1
86BKL-123A	17	456620	6816080	1
86BKL-142A	17	457370	6817420	1
86BKL-146A	17	456750	6817600	1
86BKL-156C	17	449200	6819300	1
86BKL-162A	17	452200	6818670	1
86BKM-290A	17	486590	6777210	1
87BK-104A	17	446190	6824270	1
87BK-109A	17	445730	6823330	1
87BK-155A	17	461250	6833550	1
87BK-177A	17	461200	6835850	1
87BK-228A	17	459440	6835180	1
87BK-29A	17	459320	6827760	1
87BK-4B	17	464060	6832030	1
87BK-52A	17	459900	6825640	1
87BK-55A	17	459780	6823480	1
87BK-61A	17	456910	6821800	1
87BK-64B	17	457000	6820090	1
87BK-81C	17	456820	6824100	1
87BK-81D	17	456820	6824100	1
87BKO-21A	17	458390	6827730	1
87BKO-21A	17	458390	6827730	1
87BKO-36A	17	453890	6823080	1
87BKO-50A	17	459600	6826400	1
87BKO-62A	17	456200	6821900	1
87BKO-63A	17	455530	6821400	1
87BKO-70A	17	453480	6818440	1
87BKO-78A	17	452260	6818200	1
89BK-9X	17	446190	6824270	1
91BK-618A	17	568690	6674430	1
91BK-642A	17	569030	6679050	1
85BKJ-444A	19	443910	6796350	1
81BKH-126B	21	522350	6750350	1
85B0109A	21	532000	6778640	1
85BK-104A	21	529520	6777770	1
88BK-513C	21	447080	6783210	1
85BKJ-220C	22	475000	6783110	1
88BK-443A	22	495800	6785580	1
88BK-443B	22	495800	6785580	1
88BK-452C	22	498380	6786740	1
89BK-70A	22	500490	6795080	1
85BKJ-115C	23	475190	6788500	1
83BKJ-298B	28	564170	6723350	1
87B-218A	28	463270	6837820	1
87BK-139A	28	444240	6820740	1

TOURMALINE DATA TABLE

SMPL/STN	TYPE	EASTING	NORTHING	TOURMALINE
87BK-80A	28	443200	6817010	1
87BKO-34A	28	455600	6823960	1
87BKO-38A	28	455000	6823310	1
81BK-447B	29	522790	6759730	1
85BK-65A	29	527120	6773990	1
85BKK-62A	31	419800	6781000	1
87BK-637A	38	532640	6860180	1
83BK-406A	12	559210	6711800	2
81BK-208A	13	548890	6709050	2
81BK-650A	13	548070	6713120	2
83BK-94A	13	563590	6702600	2
91BK-640A	13	568760	6679220	2
85BK-569D	17	446900	6816590	2
85BKJ-448A	17	446200	6796760	2
85BKK-81A	17	450400	6797200	2
86BKL-150D	17	456750	6818450	2
86BKL-169A	17	455470	6811080	2
86BKL-169C	17	455470	6811080	2
86BKL-70B	17	445800	6814850	2
89BK-11A	21	530920	6849740	2
86BK-606	22	520320	6870810	2
87BK-81H	22	456820	6824100	2
87BKO-412D	22	527880	6837120	2
86BKM-54B	23	501310	6801410	2
86BK-714A	26	528190	6829010	2
86BK-775b	26	537560	6717750	2
86BKM-290D	26	486590	6777210	2
87BKO-430A	26	528960	6841150	2
85BKJ-209A	28	476250	6784530	2
83BKJ-744D	48	501170	6762800	2
81BKF-172C	13	544360	6714930	3
88BK-530B	22	446920	6786010	4
85BKJ-355B	17	453230	6796600	5
86BK-370E	17	492780	6765760	8

KEY to Lithologic TYPE:

12 =	Greywacke-Mudstone	29 =	Conglomerate
13 =	Greenschist	38 =	Gagnon Granite
17 =	Paragneiss	48 =	Veins
21 =	Mixed Gneiss (unspecified)		
22 =	Slave Granite	Tourmaline Abundance	
23 =	Konth Granite	vis =	Visible in Outcrop
26 =	Pegmatite	1 =	Trace
25 =	Granodiorite to Diorite	2 =	1 to 5 per cent
28 =	Mylonite	>2 =	> 5 per cent