GEOLOGICAL AND GEOCHEMICAL REPORT
ON THE PART 1-32 MINERAL CLAIMS
PARTRIDGE LAKE, YUKON TERRITORY

WHITEHORSE MINING DISTRICT

LATITUDE 60° 02' NORTH LONGITUDE 135° 12' WEST

N.T.S. MAP SHEET 105-D/3E

Based on work completed between the
6th and 26th of June and 14 and 24th September, 1978

For
E & B Explorations Ltd.

By
R.R. Culbert, PhD., P.Eng.

090464

D.G. Leighton & Associates Ltd.

28 February 1979

This report has been examined by the Geological Evaluation Unit and is recommended to the Commissioner to be considered as representation work in the amount of $3,200.00

D.B. Craig

Resident Geologist or
Resident Mining Engineer

Considered as representation work under Section 53 (4) Yukon Quartz Mining Act.

B.R. BAXTER
Supervising Mining Recorder

Commissioner of Yukon Territory

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PART PROPERTY
PARTRIDGE LAKE, YUKON TERRITORY

INTRODUCTION

This report describes the results of geological and geochemical surveys completed on the PART property during the 1978 field season. Object of the program was the discovery of significant uranium mineralization. Interest in the area originated with the occurrence of geochemical anomalies from regional sampling.

Work on the PART property was done in two stages:

1. during June 6-26 as part of a larger program involving a number of properties in the Bennett Lake region of B.C. and the Yukon,

2. during September 14-24 as part of a follow-up program based on results generated during the first stage.

The conclusions and recommendations set forth here are based on the work cited above.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

1. The PART property, comprised of 32 unsurveyed mineral claims, is located between Partridge Lake and Bennet Lake west arm, 30 kilometres southwest of Carcross, Yukon Territory.

2. The property lies at the northern margin of the Bennett Lake cauldron complex, and is underlain by ash flow pyroclastic volcanic rocks, brecciated quartz monzonite and basal conglomerate at the volcanic/intrusive rock contact.

3. Strong geochemical anomalies were generated from analysis of stream sediment samples taken from the claim area. The highest values are from organic-rich samples but some inorganic samples are also anomalous.

4. Extensive prospecting failed to turn up zones of high radioactivity along the basal conglomerate; a radioactive occurrence was located along a fracture zone within an ash flow unit near a galena showing. Several other base metal showings were encountered.

5. A major north-south trending lineament cuts the property, but rocks along it are obscured by overburden. The highest stream sediment value (5,495 ppm uranium) and several other anomalous values occur along this structure.

6. The high outcrop ratio facilitated exploration on most of the claims. Most areas were well explored and are therefore not recommended for further work. However, the 5,495 ppm stream sediment location over the major lineament should be investigated.

7. Recommended work includes:

   (a) Hand trenching in conjunction with geochemical soil sampling on a very close grid along the target lineament to identify more accurately the source of uranium ions;

   (b) A VLF-EM survey over the above grid to delineate structure;

   (c) A diamond drill test consisting of two holes. These should be inclined so as to intersect targets at least 30 metres below surface.

Respectfully submitted,

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
R. R. CULBERT

R.R. Culbert, PhD., P.Eng

28 February 1979

GENERAL DESCRIPTIONS

Location and Access

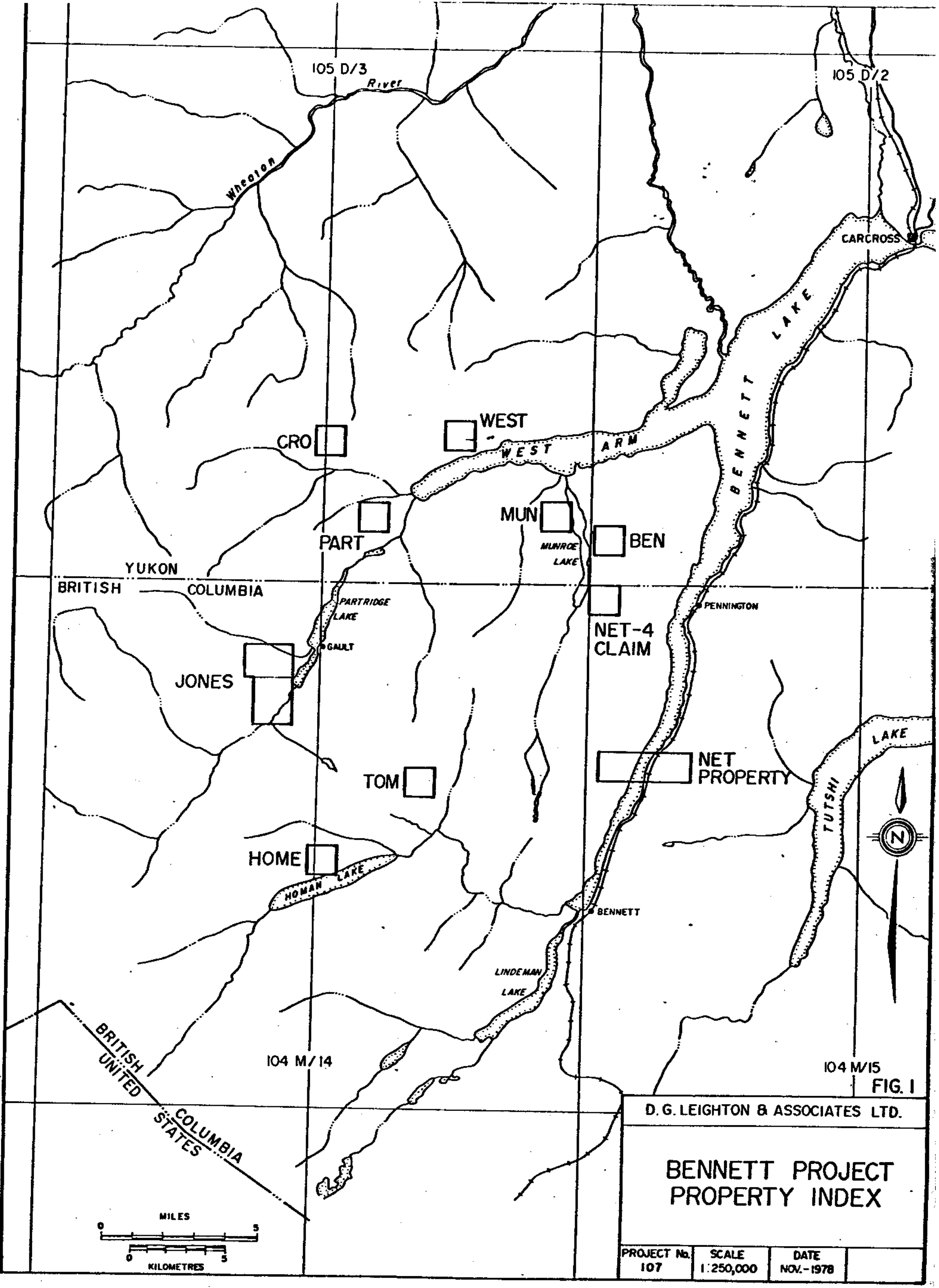
Latitude 60° 02' North; longitude 135° 12' West. Located northwest of the Partridge River between Partridge Lake and the west arm of Bennett Lake, 30 kilometres southwest of Carcross and 78 kilometres south of Whitehorse, Yukon Territory. Access is by means of helicopter from Whitehorse. The Partridge River is not navigable.

Most of the property consists of elevated rocky lowlands lying between 2,400 and 2,800 feet asl along the bottom of the broad U-shaped Partridge Valley. Rock exposure is generally excellent, although alluvium obscures areas in proximity to the river and occasional swampy areas occur in lineaments between rocky knolls. West of the low-lying area, a very steep valley wall extends to a ridge at 5,000 feet, at the break-in-slope, widespread areas of slide alder, talus and scrub fir obscure the geology and make travel arduous.

Claims

The PART claims consist of the following:

Claims	Grant No.	Record Date	Expiry
Part 1-32	YA22569-YA22598	25 April 1978	1979


105 D/3
River
Wheaton
105 D/2
CARCROSS
BENNETT LAKE
WEST
CRO
WEST ARM
PART
MUN
MUNROE LAKE
BEN
YUKON
BRITISH COLUMBIA
PARTRIDGE LAKE
GAULT
PENNINGTON
NET-4 CLAIM
JONES
NET PROPERTY
TUTSHI LAKE
TOM
HOME
HOMAN LAKE
BENNETT
LINDEMAN LAKE
104 M/14
104 M/15
BRITISH COLUMBIA
UNITED STATES
MILES
0
5
KILOMETRES
0
5
N
D. G. LEIGHTON & ASSOCIATES LTD.
BENNETT PROJECT
PROPERTY INDEX
PROJECT No. 107
SCALE 1:250,000
DATE NOV.-1978
FIG. 1

GEOLOGY

Two major rock types occur on the property: shattered pink quartz monzonite underlying rhyodacite ash flow tuff. Intermittently along the contact between these two units is a thin basal conglomerate unit.

Shattered pink quartz monzonite crops out on rocky knolls over most of the northern part of the property. It is characterized by a pink-green to grey colouration due to the alteration of feldspar and mafic minerals and by intense unoriented hairline fracturing, with fractures completely sealed by epidote and chlorite. In hand specimen, rock looks much like syenite, being medium grained, homogeneous and competent, breaking across sealed fractures, not along them. Unsealed fractures are rare. An average model composition in thin section (Lambert, 1974) is 18% quartz, 33% plagioclase (An_{30}), 38% orthoclase, 0-5% remnant biotite and hornblende, 5% chlorite, 0-3% epidote and traces of apatite, zircon and opaque grains. Quartz in hand specimen is difficult to observe.

No pronounced variation in intensity, direction or style of fracturing was observed over the outcrop area of pink quartz monzonite. The style of alteration and fracturing suggests it is due to gas streaming from explosive volcanism during caldera formation. Rhyolite and andesite dikes frequently cross-cut the quartz monzonite, and small steeply dipping seams of intense chlorite-epidote alteration are sometimes seen. Radioactivity of the quartz monzonite varies from 90-130 cps; no variation in radioactivity occurs in more intensely altered zones.

Between the pink quartz monzonite and ignimbrite units is a discontinuous bed of conglomerate up to 40 m thick. The conglomerate is well exposed on the ridge northwest of the property and at the base of the steep buttress 2,200 feet below the ridge, but does not occur along most of the contact in the valley area. The conglomerate is composed of unsorted, unoriented, 0.5-15 cm wide, angular to sub-rounded pebbles and cobbles set in a greenish well-indurated matrix of the same rock types. Fragments are largely composed of underlying quartz monzonite, but Yukon Group quartzite and gneiss cobbles are common, as are white quartz pebbles of unknown origin. Radioactivity of the conglomerate averages 100 cps. Low porosity and permeability of the conglomerate make it an unlikely channelway for modern uranium-bearing solutions.

The ignimbrite unit occurs in most of the southern part of the property. Though considerable variation was seen over the outcrop area of this unit in grain size, degree of welding, colour and composition, not enough data exists to delineate discrete flows. The unit varies from black to green rhyolite to dacite, and strongly welded to poorly welded. Several ignimbrite, lapilli tuff and volcanic breccia beds occur within the unit.

Near Partridge River at grid point 1,200E, 200S, a thin bed of volcanic tuff breccia exists, consisting of angular blocks of quartz-rich unaltered quartz monzonite up to 1.5 m wide and smaller fragments of rhyodacite set in a matrix of aphanitic green rhyolite. Near grid point 950E, 50N, a 6 m wide bed of quartz-pebble conglomerate occurs between rhyolite lapilli tuff and rhyodacite ignimbrite beds. Quartz pebbles are 1-2 cm wide, bright white, and occur with rhyodacite pebbles. Radioactivity of the overall unit averages 150 cps. The ignimbrite unit is poorly fractured and tightly sealed. The contact between ignimbrite and quartz monzonite is irregular and dips 20°-30° to the south.

Rare quartz-feldspar porphyry rhyolite dikes cross-cut the ignimbrite unit.

STRUCTURE

Numerous prominent lineaments cut the property, clearly visible on the grond and on airphotos as belts of swamps and topographic lows. These lineaments are probably representative of fault and fracture zones of uncertain displacement. They occur mainly in two sets: a dominant 034^{o} set and a subordinate 355^{o}-005^{o} set. The most prominent lineament occurs along the junction of the steep valley side and the valley bottom, but is obscured by swamp and bush cover over its entire length. Although negligible strike-slip movement is indicated by the appearance of conglomerate on either side of this lineament, considerable dip-slip movement may have occurred to form a major graben in the valley and to place the ignimbrite unit stratigraphically up to 2,000 feet lower than it originated.

Alternatively, if little movement occurred along this major lineament, the existing rock pattern and south dips of 20^{o}-40^{o} of the conglomerate and ignimbrite over the quartz monzonite are explainable by postulating that subsequent to deposition of conglomerate and ignimbrite, an uprising magma caused doming, faulting and perhaps gas shattering of the pink quartz monzonite.

MINERALIZATION

Scattered occurrences of malachite, chalcopyrite, pyrite and galena occur within the ignimbrite unit. Showings are associated with narrow fracture zones in which traces of sulphide mineralization are disseminated in altered rhyodacite. An isolated radioactive occurrence was found within ignimbrite near a galena showing, a grab sample assaying 308 ppm uranium. The occurrence was of limited size and involved a minor fracture system. A second radioactive rock zone (376 ppm) was discovered near the northern limit of the property.

GEOCHEMISTRY

On the PART property strong uranium anomalies coincide with a major lineament near the base of rock bluffs which form the northern portion of the claims. These are water-transported concentrations accompanied by little in the way of daughter products, except for minor radium near springs. These are not polymetallic anomalies, although a few cases of slightly elevated thorium were observed. The lineament is an area of almost total overburden. The only visible drill target here would be uranium deposits associated with the primary structure indicated or with secondary shears.

Two smaller anomalies are worthy of examination during the course of other work on the PART property. One of these occurs immediately southeast of the soil grid; the other is a single sample (P4) located near the camp site, which contained 152 ppm uranium and extremely high values in other metals (see Table I).

TABLE I

PART PROPERTY GEOCHEMICAL DATA

EXPLANATION OF HEADINGS
*********** ** ********

SM-- A ONE LETTER CODE DENOTING WHO TOOK THE SAMPLE

SAMP NUMB-- FIELD NUMBER ASSIGNED TO SAMPLE. A '*' FOLLOWING NUMBER INDICATES THAT MULTI-METAL ANALYSIS WAS MADE. SEE APPENDIX I.

TYP-- TYPE OF SAMPLE TAKEN, AS FOLLOWS:
- STRM- STREAM SILT OR WATERCOURSE.
- LAKE- LAKE OR POND SEDIMENT.
- SPRG- SEDIMENT FROM SPRING OR SEEP.
- LINS- LINEAMENT OR GULLY SOIL SAMPLE.
- GRID- SOIL TAKEN BY GRID OR LINE SPACING.
- AUGR- AUGER SAMPLE OF SOIL OR BOG.
- ROCK- ROCK SAMPLE.

SPEC GRAV-- SPECIFIC GRAVITY OF SAMPLE IN GMS/CC. GOOD SILT OR POWDERED ROCKS ARE ROUGHLY 1 GM/CC, WHILE ORGANIC SAMPLES RANGE MUCH LOWER.

URANIUM PPM-- PARTS PER MILLION URANIUM, WITH STANDARD ERROR FOR THE DETERMINATION IN BRACKETS.

PB-214-- LEAD-214, A URANIUM DAUGHTER PRODUCT WHICH FOLLOWS THE RADON ESCAPE POINT IN DECAY SERIES. GIVEN IN EQUIVALENT PPM URANIUM.

RADM 226-- RADIUM 226, A URANIUM DAUGHTER PRODUCT WHICH FOLLOWS THE MAJOR DISEQUILIBRIUM POINT IN THE DECAY SERIES, BUT OCCURS BEFORE RADON. GIVEN IN EQUIVALENT PPM URANIUM.

TH PPM-- PARTS PER MILLION THORIUM.

EQU LIB-- PERCENTAGE EQUILIBRIUM BETWEEN URANIUM AND ITS DAUGHTER RADIUM. VALUES OVER 100 INDICATE DAUGHTER EXCESS AND ARE TYPICAL OF CERTAIN TYPES OF LEACHING. LOW VALUES INDICATE MOBILIZED URANIUM (WATER TRANSPORT ANOMALY) IN SEDIMENTS AND SOILS, OR RELATIVE LEACHING OF RADIUM FROM ROCKS. BLANKS DELETE CASES OF URANIUM WITHIN TWO STANDARD ERRORS OF ZERO-- (IE.-- POOR STATISTICS FOR RATIOS).

RAD ESC-- RADON ESCAPE COEFFICIENT, GIVING DISEQUILIBRIUM DUE TO RADON ESCAPE FROM RADIUM. HIGH VALUES INDICATE LOOSELY HELD RADIUM, TYPICAL OF SPRING OR SEEPAGE ACCUMULATIONS.

FIELD COMMENTS-- ARE NOTES MADE BY SAMPLER TO FACILITATE RECOGNITION OF THE SAMPLE CASE.

D.G. LEIGHTON AND ASSOC. LTD.
NOVEMBER 2, 1978.

BENNETT PROJECT - 1978 GEOCHEMICAL DATA

**** PART PROPERTY-- LESSER PARTRIDGE LAKE, YUKON

S M	SAMP NUMB	TYP	SPEC GRAV	URANIUM PPM	PB-214 PPM EQV	RADM 226	TH PPM	ECU LIB	RAD ESC	FIELD COMMENTS
A	PR 1	LAKE	0.26	24 (24)	6 (5)					PART SWAMP ORG
A	PR 2	STRM	0.30	82 (23)	(5)	18	35	22		PART CRK 2 FT
A	PR 3	STRM	0.50	70 (15)	2 (3)	27	35	39		PART CRK 2FT
A	PR 9	LINS	0.72	22 (9)	2 (2)	4	13	22		PART SOIL HOTSP
A	PR 12*	STRM	0.21	274 (37)	19 (7)	76	16	28		PART SMALL CRK
A	PR 14	STRM	0.52	70 (14)	7 (3)	13	23	19		PART CRK 2FT
A	610782	ROCK	1.35	232 (10)	149 (2)	220		94	32	LES ZONE-PARTR
A	6 9781	ROCK	1.20	15 (4)	10 (1)	14	26	93	28	PART IGNIM
B	PA 1	STRM	1.01	18 (7)	7 (1)	8	17	45		CAMP CK 200M UP
B	PA 2	STRM	0.52	87 (6)	7 (1)	27	19	31	72	CAMP CK
B	PA 3	STRM	0.84	134 (4)	3 ( )	11	15	8		TRICK TRIB CAMP
B	PA 4	STRM	0.52	22 (14)	6 (3)	10	33			HOT CK AT TOP
B	PA 5	STRM	0.48	18 (15)	9 (3)	1	27			HOT CK
B	PA 6	STRM	0.66	93 (5)	9 (1)	4	24	4		HOT CK
B	PA 7	STRM	0.80	7 (4)	6 ( )	9	26			HOT CK
B	PA 8	STRM	0.40	78 (7)	5 (1)	13	12	16		HOT CK SWAMP
B	PA 12	STRM	0.64	38 (12)	7 (2)	9	27	25		W OF CAMP-WIDEN
B	PA 13	STRM	0.88	(8)	8 (2)	12	30		33	S DR E END PARTL
B	PA 14	STRM	0.65	45 (11)	5 (2)	15	21	35		S DR E END PARTL
B	PA 15	STRM	0.49	67 (7)	12 (1)	23	31	35	48	W END WIDE PARTF
B	PA 16	STRM	0.59	37 (5)	8 (1)	8	19	24		W CAMP WIDENING
B	PA 17	LINS	1.12	10 (7)	14 (1)	17	19		20	SOIL GULY E LHTS
B	PA 18	STRM	0.69	5 (11)	8 (2)	7	28			DR S ACX LEMIEUX
B	PA 19	STRM	0.78	32 (10)	3 (2)	1	27	4		CAMP CK AT ELBOW
B	PA 20	STRM	0.68	53 (11)	7 (2)	11	22	21		CAMP CK BASE WAF
B	PA20R	ROCK	0.88	179 (13)	213 (3)	215	8	120	1	LES-HOT RUSTY RX
B	PA 21	STRM	0.74	70 (11)	5 (2)	18	27	25		CAMP CK
B	PA21R	ROCK	0.87	6 (5)	5 (1)	6	26			IGNIMBRITE
B	PA 22	STRM	1.04	18 (8)	10 (1)	10	26	55		CAMP CK AT CAMP
B	PA22R	ROCK	0.94	13 (4)	2 (1)		15	2		ANDESITE DIKE
B	PA23S	STRM	0.40	55 (19)	15 (4)	8	25	14		MOD ORG DRY CK
B	PA24S	STRM		166 (21)	7 (4)	25	24	15		MOD ORG SLOW CK
B	PA25S	STRM	0.52	119 (16)	13 (3)	5	34	4		DRY CK MOD ORG
B	PA26S*	STRM	0.60	83 (13)	6 (2)	12	23	15		WK CK MOD ORG
B	PA28R	ROCK	1.05	13 (5)	6 (1)	2	27	19		IGNIMBRITE
B	PA29R	ROCK	0.97	(5)	8 (1)	7	26			IGNIM
B	PA30R	ROCK	0.93	17 (5)	7 (1)	6	20	38		IGNIM
B	PA32R	ROCK	1.09	12 (4)	3 (1)	6	25	50		BASAL CONGLOM
B	PA33R	ROCK	0.96	11 (4)	3 (1)	4	8	43		DACITE
B	PA34S	STRM	0.90	55 (9)	7 (2)	22	29	41		FINE ACTIVE SILT
B	PA35R	ROCK	0.96	13 (5)	8 (1)	8	27	65		GAL-PY SHOW -RHY
B	PA36S*	STRM	0.87	317 (13)	8 (2)	51	12	16		HI ORG-SLT SPRNG
B	PA37Z	STRM		5495 (99)	42 (11)	863	125	15		R/A BL MUD HIORG
B	PTA 5	AUGR	0.18	60 (34)	1 (7)					2.5-5FT HI ORG
B	PTA7.5	AUGR	0.25	90 (27)	(5)		56			5-7.5FT BR ORG
B	PTA 10	AUGR	0.29	182 (26)	10 (5)					7.5-10FT BR CLAY
B	PTA 11	AUGR		78 (18)	9 (4)					10-11FT BR SLTCL
B	PTB 4	AUGR	0.92	15 (7)	4 (1)	11	11			HOLEB 0-4FT
B	PTC2.5	AUGR	0.21	33 (33)	19 (7)		45			0-2.5FT HI ORG
B	PTC 5	AUGR	0.48	67 (15)	7 (3)		19			2.5-5FT SLT-CLAY
B	PTC 6	AUGR	0.71	24 (10)	1 (2)		32			5-6FT BL SND-CLY
B	PTD 2	AUGR	0.74	41 (10)	7 (2)	7	17	18		0-2FT SAND-CLAY
B	PTE 2	AUGR		1010 (58)	17 (9)	172	57	17		0-2FT BR ORG

**** PART PROPERTY-- LESSER PARTRICGE LAKE, YUKON

S M	SAMP NUMB	TYP	SPEC GRAV	URANIUM PPM	PB-214 PPM EQV	RADM 226	TH PPM	EQU LIB	RAD ESC	FIELD COMMENT:
BPTF	4	AUGR	1.07	22 (7)	3 (1)	4	18	19		HOLEF 2.5-4FT
BPTF2.5		AUGR	0.68	147 (13)	4 (2)	21	13	14		HOLEF 0-2.5FT
BPTG2.5		AUGR	0.23	160 (30)	(6)		9			0-2.5FT ORG GOO
BPTG	5	AUGR	0.23	198 (32)	4 (6)	30	41	15		2.5-5FT ORG GOO
BPTG6.5		AUGR	0.24	277 (33)	1 (6)	46	51	16		5-6.5FT ORG GOO
BPTH	2	AUGR	0.89	15 (8)	10 (1)	14	5		26	0-2FT SANDY
B0+537N		STRM	0.59	30 (12)	3 (2)		18			ORK CK
B	12-77	STRM	0.66	40 (11)	2 (2)	17	15	44		SLOW SEEP
B	19-11*	STRM	0.48	102 (16)	(3)	12	27	11		HI ORG-SWAMP SL
C	PA 1	LINS	0.61	9 (11)	7 (2)	20	19			BOUND LIN SUMMI
C	PA 2	LAKE	0.58	24 (12)	8 (2)	6	5			PCNC OVER GRAN
C	PA 3	STRM	0.58	6 (13)	9 (3)	24	50			CREEK BY RIDGE
C	PA 4	SPRG	0.49	93 (15)	11 (3)	28	5	30		SMALL RIDGE SP
C	PA 5	STRM	0.49	40 (14)	8 (3)	14	15	36		CREEK BELOW
C	PA 6	STRM	0.51	15 (13)	2 (2)	2	13			W TRIB
C	PA 7	STRM	0.54	6 (12)	11 (3)	14				FAR W TRIB
C	PA 8	LAKE	0.70	9 (9)	3 (2)	7	5			MARSH OVER VOL
C	PA 9	LAKE	0.33	38 (19)	(4)	17	5			CONTACT MARSH
C	PA 10	STRM		15 (32)	11 (7)	13				CONTACT AREA
C	PA 11	LAKE		(31)	8 (7)	2				S CCN POND
C	PA11A	LAKE		(38)	18 (9)	15				
C	PA 12	LINS	0.47	10 (14)	6 (3)	1	17			S CCN AREA
C	PA 15	STRM	1.10	19 (7)	6 (1)	7	15	41		PART LK GULLIES
C	PA 16	STRM		45 (15)	3 (3)	15	39	34		2ND GULLY
C	PA 17	STRM	0.74	12 (10)	7 (2)	21	31			
C	PA 18	STRM	0.79	34 (10)	7 (2)	19	18	56		
C	PA 19	STRM	0.69	41 (10)	2 (2)	3	24	8		S BOUND CR
C	PA 20	STRM	0.67	182 (14)	13 (2)	40	19	22	66	CCNTACT SPRING
C	PA 21	SPRG	0.68	93 (12)	4 (2)	17	16	19		SPRING TO N
C	PR 50	STRM	0.33	1045 (38)	10 (5)	157	39	15		ABOVE LAKES
C	PR 51*	STRM	0.80	89 (11)	9 (2)	7	22	7		HV METAL SITE
CA	-1	RCCK	1.29	8 (4)	8 ( )	10	23			PART SYEN
CA	2	ROCK	1.29	5 (4)	6 ( )	4	21			PART SYEN
CA	3	ROCK	1.15	8 (4)	6 (1)	8	24			PART SYEN
CA	4	RCCK	1.20	19 (4)	5 ( )	5	21	29		PART VOLC
CA	5	ROCK	1.13	137 (9)	95 (2)	117	25	85	18	LES ZONE
CA	5A*	ROCK	1.28	308 (13)	254 (3)	286	40	92	11	LES ZONE
CA	10*	ROCK	1.34	376 (13)	296 (3)	357	68	94	17	ALDER ZONE
CA	V	ROCK	1.31	11 (4)	8 ( )	8	21	80		PART VOLC
P	PA 1S	STRM	0.81	22 (10)	10 (2)		22			1650E 1290N DRY
P	PA 2S	STRM	0.87	57 (12)	38 (2)	36	11	64		910E 130S
P	PA 3S	LAKE	0.54	92 (14)	7 (3)	20	14	22		375E +00
P	PA 4S*	SPRG	0.57	152 (18)	15 (3)	41	100	27	63	500E +150N
P	PA 6S	STRM	0.71	32 (10)	9 (2)	22	15	71		PARTSTREAMCIRQUE
P	PA11S	STRM	0.76	24 (11)	8 (2)	12	40	51		PARTSTREAM-CIRQ.
P	PA12S	STRM	0.69	23 (11)	5 (2)	15	33	66		
P	PA13S	STRM	0.87	9 (9)	9 (2)	4	26			4000FT
P	PA14S	STRM	0.85	19 (9)	6 (2)	3	33			
P	PA15S	STRM	0.71	33 (10)	7 (2)	9	17	27		3500FT
P	PA16S	STRM		10 (12)	12 (2)	10	19			
P	PA17S	STRM	0.86	27 (9)	7 (2)	4	29	15		2600FT
PPA	18B	GRID	0.73	11 (9)	5 (2)	8	9			1950E.+800N.
PPA	19B	GRID	0.84	13 (8)	1 (1)	1	17			1950E.+850N

**** PART PROPERTY-- LESSER PARTRIDGE LAKE, YUKON

S M	SAMP NUMB	TYP	SPEC GRAV	URANIUM PPM	PB-214 PPM EQV	RADM 226	TH PPM	EQU LIB	RAC ESC	FIELD COMMENT
P	PA 20B	GRID	0.75	16 (10)	7 (2)		17			1950E +900N
P	PA21B	GRID		38 (57)	(13)		67			1950E + 925N
P	PA 22B	GRID	0.95	12 (7)	9 (1)	5	4			+950N
P	PA23B	GRID	0.29	25 (20)	(4)		14			1950E + 1000N
P	PA 24B	GRID	0.80	8 (8)	3 (1)	1	13			+1050N
P	PA 25B	GRID	0.91	(7)	6 (1)	10	8			+1100N
P	PA 26B	GRID	0.94	7 (7)	3 (1)	8	12			+1150N
P	PA 27B	GRID	0.89	17 (7)	2 (1)	3	8	18		+1200N
P	PA 28B	GRID	0.87	(8)	4 (1)		21			1800E +1225N
P	PA 29B	GRID	0.32	62 (22)	1 (4)		47			+1200N
P	PA 30B	GRID	0.88	3 (8)	1 (1)		21			+1150N
P	PA 31B	GRID	0.94	(7)	5 (1)	6	18			+1100N
P	PA 32B	GRID	0.66	30 (11)	2 (2)	11	36	36		+1075N
P	PA 33B	GRID	0.79	32 (9)	6 (2)	9	15	30		+1050N
P	PA 34B	GRID	0.79	2 (8)	5 (2)	1	10			+1000N
P	PA 35B	GRID	0.91	9 (8)	6 (1)		11			+950N
P	PA 36B	GRID	0.99	(7)	4 (1)	4	16			+900N
P	PA 37B	GRID	1.01	(7)	6 (1)	3	19			+850N
P	PA 38B	GRID	1.00	3 (7)	4 (1)	4	23			+800N
P	PA 39B	GRID	0.90	(8)	5 (1)	7	32			1650E +700N
P	PA 40B	GRID	1.04	2 (6)	5 (1)	3	12			+750N
P	PA 41B	GRID	1.07	6 (6)	5 (1)	5	8			+800N
P	PA 42B	GRID	0.82	(8)	9 (2)	5	11			+850N
P	PA 43B	GRID	1.11	(6)	4 (1)	6	9			+875N
P	PA 44B	GRID	0.96	17 (7)	6 (1)	1	3	9		+900N
P	PA 45B	GRID	0.96	5 (7)	5 (1)	6	12			+950N
P	PA 46B	GRID	0.90	9 (7)	7 (1)	6	7			+950N
P	PA 47B	GRID	0.87	(8)	5 (1)	1	14			+1000N
P	PA48B	GRID	0.83	24 (8)	3 (1)		8			1650E+ 1050N
P	PA49B	GRID	0.95	(8)	9 (1)	10	16			1100N
P	PA50B	GRID		219 (23)	(4)	45	21	20		1500E+ 1200N
P	PA51B	GRID		126 (37)	(7)	28	97	22		1160N
P	PA52B	GRID	1.05	8 (6)	1 (1)	6	10			1100N
P	PA53B	GRID	0.89	1 (7)	1 (1)	8	19			1050N
P	PA54B*	GRID	0.35	285 (25)	8 (4)	26	35	9		1000N
P	PA55B	GRID	0.73	(9)	5 (2)	1	18			950N
P	PA56B	GRID	0.35	27 (19)	7 (4)	3	25			900N
P	PA57B	GRID	0.54	(11)	(2)		15			850N
P	PA58B	GRID	0.84	7 (8)	5 (1)		21			800N
P	PA59B	GRID		176 (35)	(7)					750N
P	PA60B	GRID	0.96	25 (8)	4 (1)		15	1		700N
P	PA61B	GRID	0.78	4 (8)	7 (2)	6	8			650N
P	PA62B	GRID	0.71	(9)	9 (2)	18	12			610N
P	PA63B	GRID	0.57	6 (11)	4 (2)	14	16			600N
P	PA64B	GRID	0.55	16 (11)	(2)		10			550N
P	PA65B	GRID	0.98	20 (7)	7 (1)	7	8	38		1500E+ 500N
T	PA 1	SPRG	0.65	190 (6)	6 (1)	35	16	18	80	SMLTRIBNWOF2NDL
T	PA 3	STRM	0.35	37 (19)	1 (4)		25			ORG SED
T	PA 4	STRM	0.43	(14)	5 (3)					
T	PA 5	STRM	0.35	55 (20)	9 (4)	16	9	29		N BRANCH WTFALL
T	PA 6	STRM	0.37	169 (22)	5 (4)	22	38	13		VRY ORG
T	PA 7	STRM	0.39	55 (17)	9 (4)	14	4	26		VRYORG WTFALL C
T	PA 8	STRM	0.33	174 (23)	9 (4)	58	1	33		ORG DRAINS BOG

**** PART PROPERTY-- LESSER PARTRIDGE LAKE, YUKON

S M	SAMP NUMB	TYP	SPEC GRAV	URANIUM PPM	PB-214 PPM EQV	RADM 226	TH PPM	ECU LIB	RAC ESC	FIELD COMMEN
T	PA 9	STRM	0.46	97 (7)	9 (1)	15	15	15	38	
T	PA 10	SPRG	0.46	425 (10)	12 (1)	61	31	14	79	VRY ORG BOG SPF
T	PA 11	STRM	1.14	15 (6)	6 (1)	9	3	61		
T	PA 12	LAKE	0.34	602 (14)	21 (2)	113	23	18	80	FRM BOG VRY OR(
T	PA 13	STRM	0.50	20 (13)	4 (3)		13			
T	PA 14	STRM	C.65	87 (12)	3 (2)	14	26	16		
T	PA 15	SPRG	0.47	324 (9)	7 (1)	54	31	16	85	VRY ORG FRM SEE
T	PA 16	SPRG	0.25	139 (12)	(2)	24	12	17		VRY ORG FRM SEE
T	PA 17	STRM	0.59	185 (7)	10 (1)	37	29	20	71	CRS SND & ORG
T	PA 19	STRM	0.84	157 (5)	5 ( )	27	18	17	80	SND & ORG
T	PA 20*	STRM	0.75	234 (14)	6 (2)	39	22	16		FINE SED
T	PA 20	STRM	0.67	192 (6)	10 (1)	35	23	18	69	FINE SED & ORG
T	PA 21	LAKE	0.42	165 (19)	8 (3)	32	4	19		VRY ORG FRM BOG
T	PA 22	LAKE	0.41	104 (18)	(3)	1	23	1		TRAILSIDE

APPENDIX "A"

ANALYTICAL PROCEDURE

LEGS - LOW ENERGY GAMMA SPECTROMETRY

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GEOLOGICAL CONSULTANTS

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VANCOUVER, B.C.
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LEGS - LOW ENERGY GAMMA SPECTROMETRY

INTRODUCTION

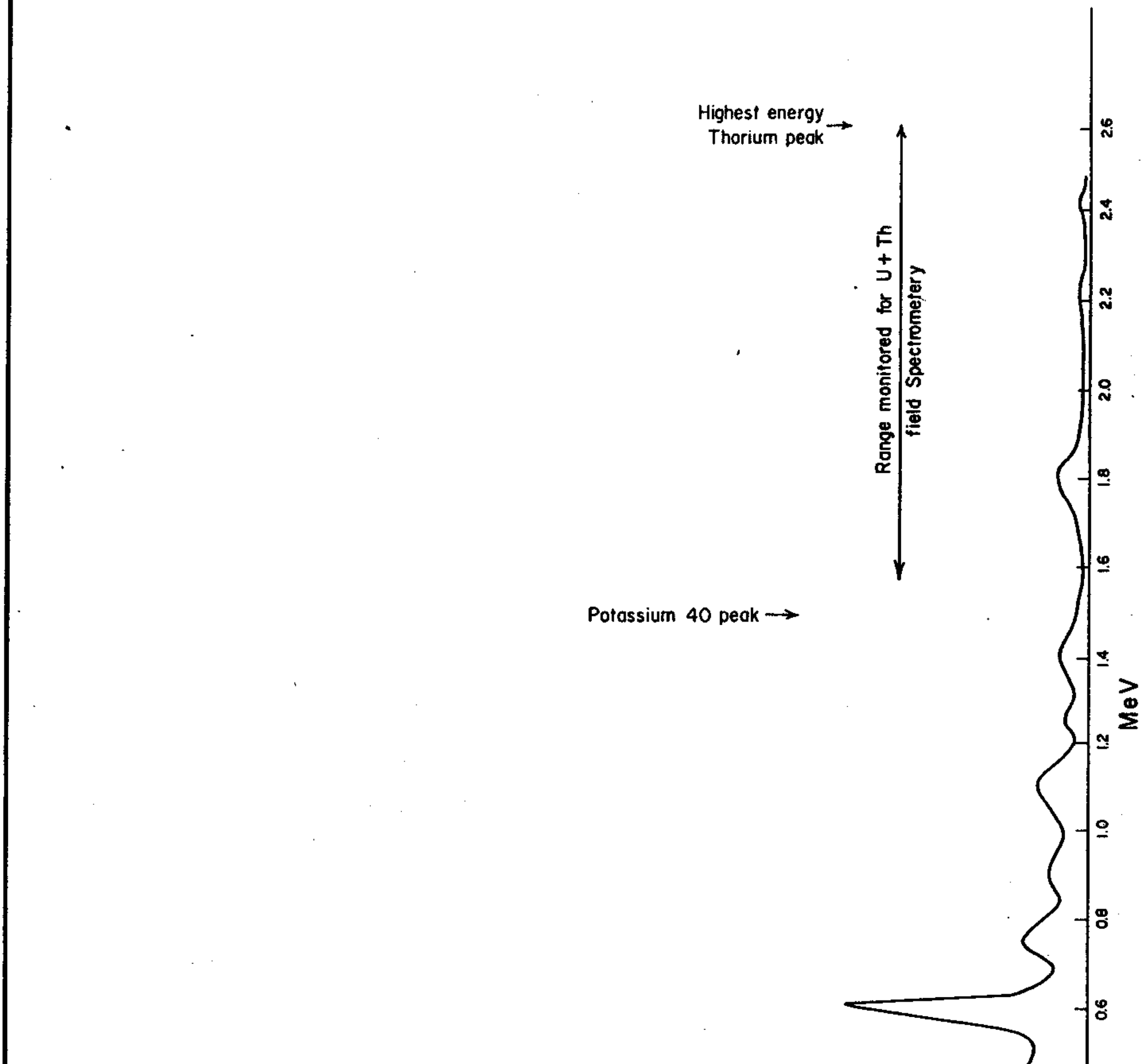
Low energy gamma spectrometry (LEGS) provides a method of determining uranium, thorium and U^{238} daughter products Pb^{214} and radium in geological samples, and has unique advantages when compared with other techniques. The system described here was developed by D.G. Leighton & Associates Ltd. with two objectives in mind. One was to provide an accurate assay facility which could be used in the field, giving field personnel rapid feedback which is particularly valuable on regional type programs. The second objective was to tackle the problem of radioactive disequilibrium. It was felt that routinely monitoring equilibrium would be useful in interpreting mobilizing mechanisms involved in uranium transport and tracking anomalies back to their source. The technique has proven to be reliable and highly cost effective in a variety of exploration programs.

METHOD

General

Conventional gamma spectrometry in geological exploration is severely limited for two reasons. First, because very high background gamma flux occurs at low energy levels (below 1 MeV), conventional systems are constrained to measure only the highest portion of the natural gamma energy range (above 1 MeV) and so cannot measure uranium directly (requiring measurements below 0.1 MeV) determining instead potassium, thorium and Bi^{214}. Unfortunately, if the geological system is in disequilibrium, considerable error will result in the value for uranium (from reliance on these measures as an indicator of uranium). In natural systems, especially in sediments and weathered rock, disequilibrium is the rule rather than the exception, due to the varying half lives and chemistries of uranium daughter products. The second limit in conventional systems is that, because only measurements at high energy levels are made, large statistical errors are introduced since at these energy levels, very low count rates occur (see Figure 1).

The LEGS system avoids both of these limitations. Measurement of the gamma spectrum at low energy levels (between 0.05 and 0.4 MeV) is achieved by ringing a 7 cm radius lead shield around both the sample and a "center-well" scintillating crystal to screen out background radiation. Since high count rates are measured at these low energy levels, a much lower statistical error exists. Moreover, uranium can be measured directly, together with two of its daughter products, so that the degree of disequilibrium in the system can be determined.



AN ORDINARY ROCK GAMMA SPECTRUM

FIGURE 1

The LEGS system, then, is a laboratory or field base method, involving a lead shielded scintillating crystal and a pulse height analyzer capable of integrating counts across preset segments of the gamma spectrum. A weighted 8.7 cc sample of the material to be analyzed is placed in a plastic vial and inserted into the scintillating crystal. Pulse counts are monitored by the pulse height analyzer and the .05 - .4 MeV gamma spectrum is broken into four segments and measured. Resultant numbers are entered into a programable desk calculator to obtain uranium and thorium content in ppm and, Ra^{226} and Pb^{214} content in percent equilibrium or ppm uranium equivalents. Background radiation corrections are involved for samples of low radioactivity and self absorption corrections for those rich in uranium or thorium.

The technique is calibrated using Geological Survey of Canada Radioactive Rock Standards, and chemical standards from Min-En Laboratories and the B.C. Department of Mines. Figure 2 shows the standardization results for uranium. These samples were counted for at least 4,000 seconds each, however, and in the usual 400 - 1,000 second geochemical analysis runs it is the counting statistic uncertainty which almost entirely controls the accuracy.

Components Measured

Although the decay sequence of uranium is very complex it may spectrographically be broken into three components (Table 1), within which the half-lives of the daughters are sufficiently short that there is unlikely to be noticeable separation of the members by natural chemical processes. The first component includes the uranium isotopes and their short lived daughter Th^{234}.

CALIBRATION STANDARDS FOR URANIUM BY L.E.G.S.

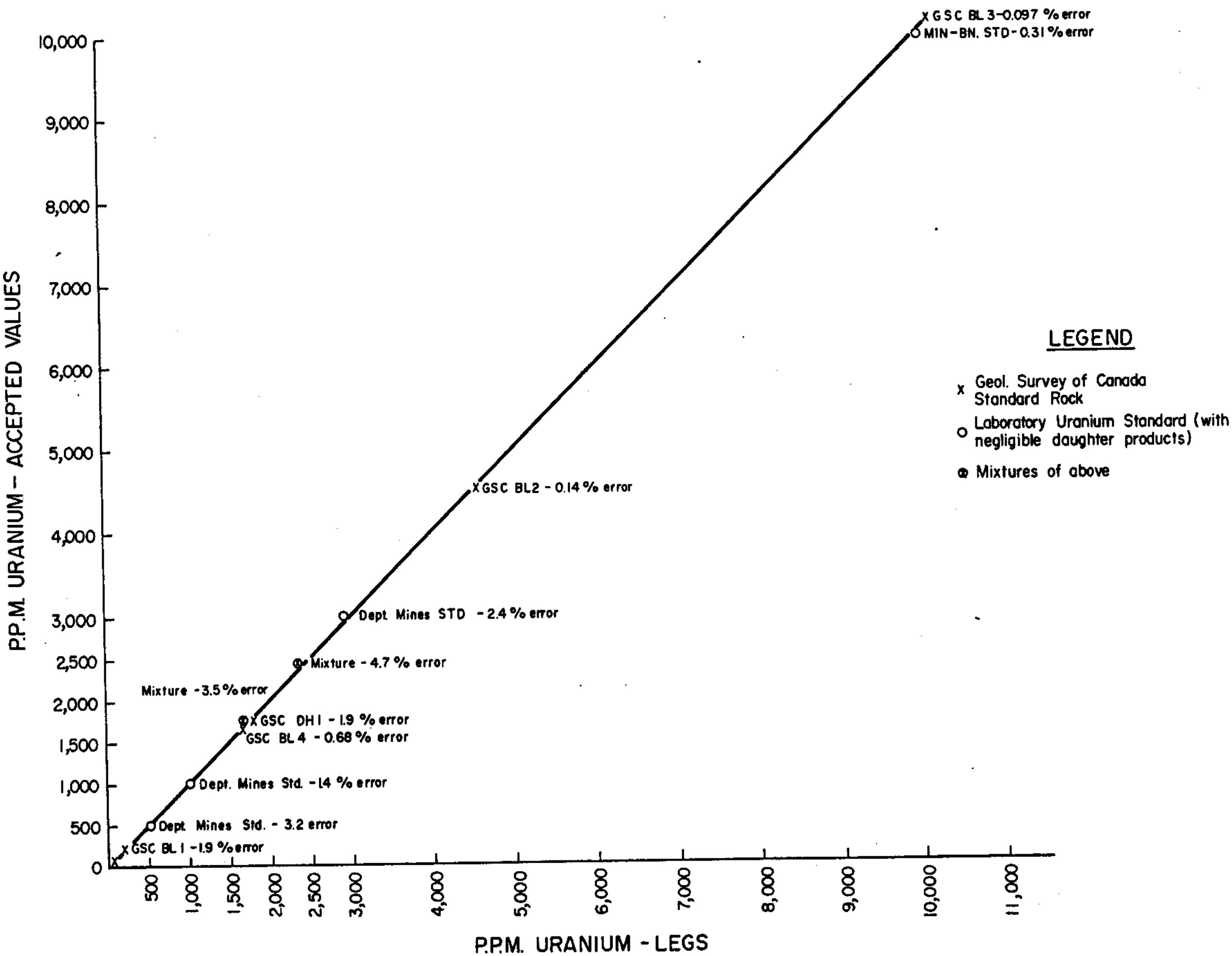


FIG. 2

TABLE 1

DISEQUILIBRIUM COMPONENTS IN U^{238} DECAY SEQUENCE (SIMPLIFIED)

	Isotope	Half Life	Importance In LEGS	Channel (Fig. 3)	Remarks
1st Component	U^{238}	4.51 x 109 yr.			
	Th^{234}	24.1 days	Major	A	Peaks at 93 and 64 KEV
	P_q^{234}	6.75 hr.			
	U^{234}	2.47 x 105 yr.	U-Minor	A	
2nd Component	Th^{230}	8.0 x 104 yr.	U-Minor	A	Major disequilibrium point
	Ra^{226}	1602 yr.	Major	B	Peak at 186 KEV
3rd Component	Rn^{222}	3.82 days			Disequilibrium due to mobility of radon gas
	Po^{218}	3.05 min.			
	Pb^{214}	26.8 min.	Major	C & D	Peaks at 242, 295 and 352 KEV
				A	Conversion x-rays at 80 KEV
	B_i^{214}	19.7 min.			Higher energy gamma emission
	Po^{214}	1.6 x 10.4 sec.			
	Pb^{210}	22.0 yr.			
	B_i^{210}	5.0 days			
	Po^{210}	138.4 days			
	Pb^{206}	Stable			

Most radiation from the U^{235} decay series may be included in this component. The 80,000 year half-life of Th^{230} provides the first break in the uranium decay series and in view of the differing chemistry of U and Th, this is a major point of disequilibrium. Th^{230} itself produces negligible gamma radiation, and so may be grouped with its daughter product, radium. Ra^{226} has a 1,602 year half-life and a chemistry similar to the alkaline earths. Its immediate daughter Radon forms the second disequilibrium break in the decay chain, for although it has a short half-life, its gaseous state gives it mobility (especially during grinding or preparation of geochemical samples). Radon itself is not a gamma emmitter, but its daughter Pb^{214} has three important low energy wave lengths, and the subsequent Bi^{214} has a variety of high energy emmissions.

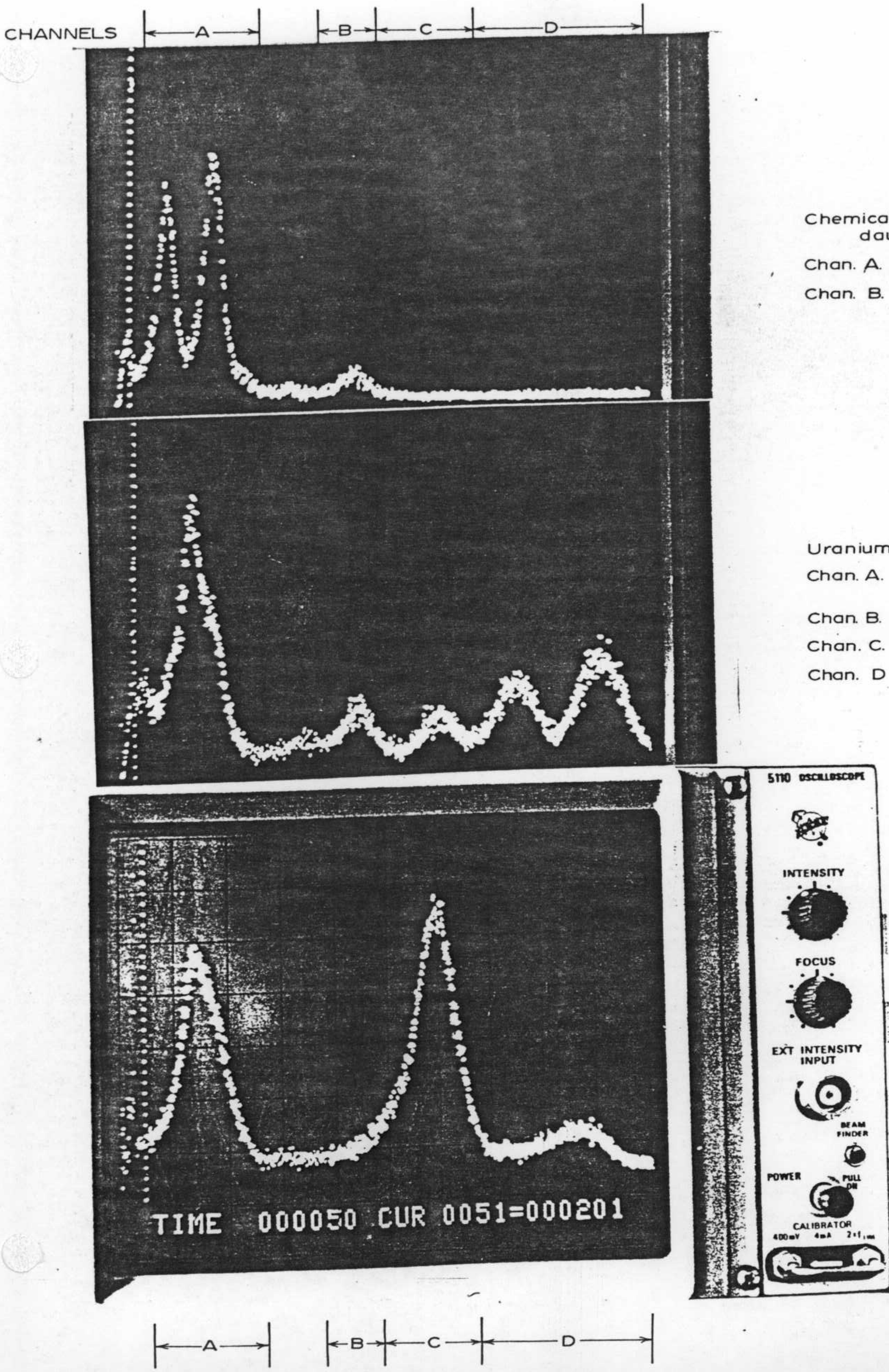
Two other radioactive components must be considered. The first of these is thorium, which is generally considered to have a fixed radiation signature in view of the short half-lives of its daughters and the especially close grouping of its major gamma emmitters. The second additional component is due to the one step decay of potassium, which does not significantly effect the technique.

Figure 3 shows the spectra of the three components of uranium radiation and thorium as viewed on the pulse height analyser. It also demonstrates how the spectrum is broken into four channels across which the counts are automatically integrated.

Precision

Both uranium and thorium are difficult elements in quantitative analysis, and the level of precision in geochemical determinations tends to be low. Figure 4 shows the results from splits

COMPARISON OF GAMMA ENERGY DISTRIBUTIONS IN THE 50-400 KEV RANGE



Chemical uranium, separated from daughter products

Chan. A. U^{238} (Via $Th.^{234}$)

Chan. B. U^{235} (Via Th^{231})

Uranium ore – approx. equilibrium

Chan. A. U^{238} and X–Rays from Pb^{214} decay

Chan. B. U^{235} and Ra^{226}

Chan. C. $Pb.^{214}$

Chan. D Pb^{214}

Thorium sample showing full cathode ray screen for pulse height analyser

FIG. 3

Comparison of duplicate analyses for uranium
between two Laboratories

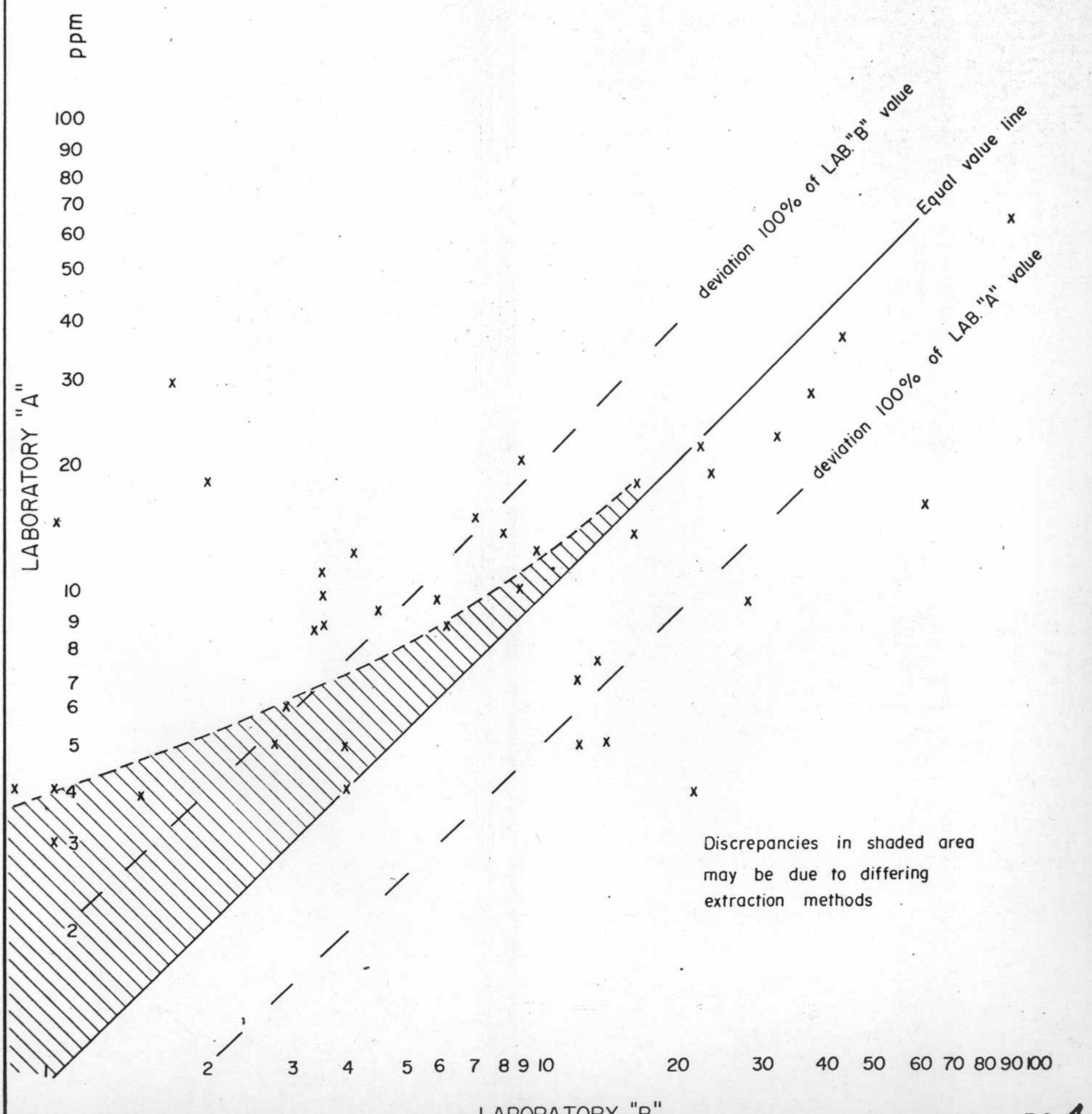


FIG. 4

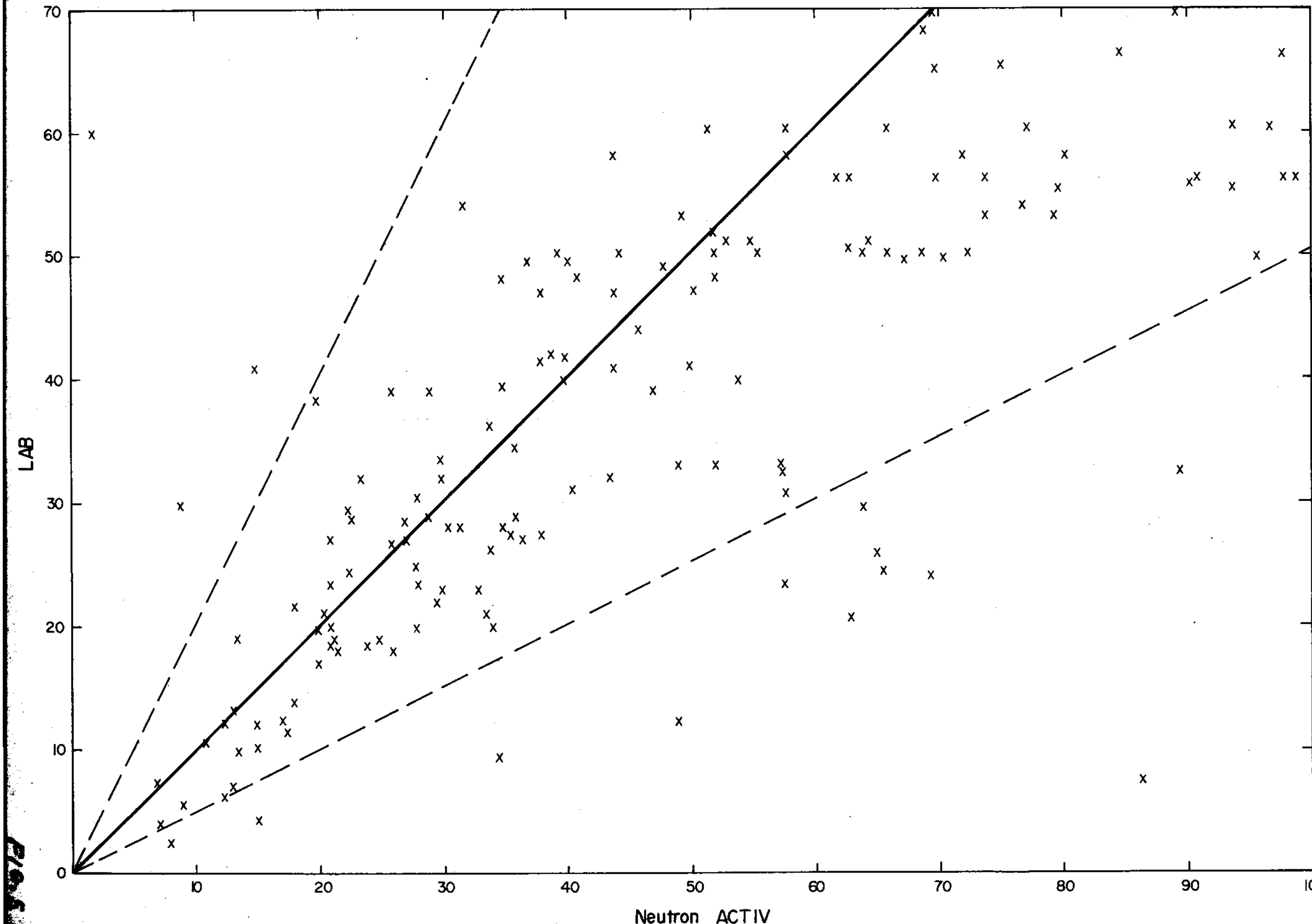
of a group of -80 mesh silt samples sent to two different laboratories, and Figure 5 gives a similar example of a laboratory fluorimetric analysis (with unusually strong acid extraction) compared to neutron activation. The results show clearly that ordinary uranium geochemical determinations are really only semi-quantitative. "Assay-mode" delayed activation neutron analysis is as good as is rountinely available, in our opinion.

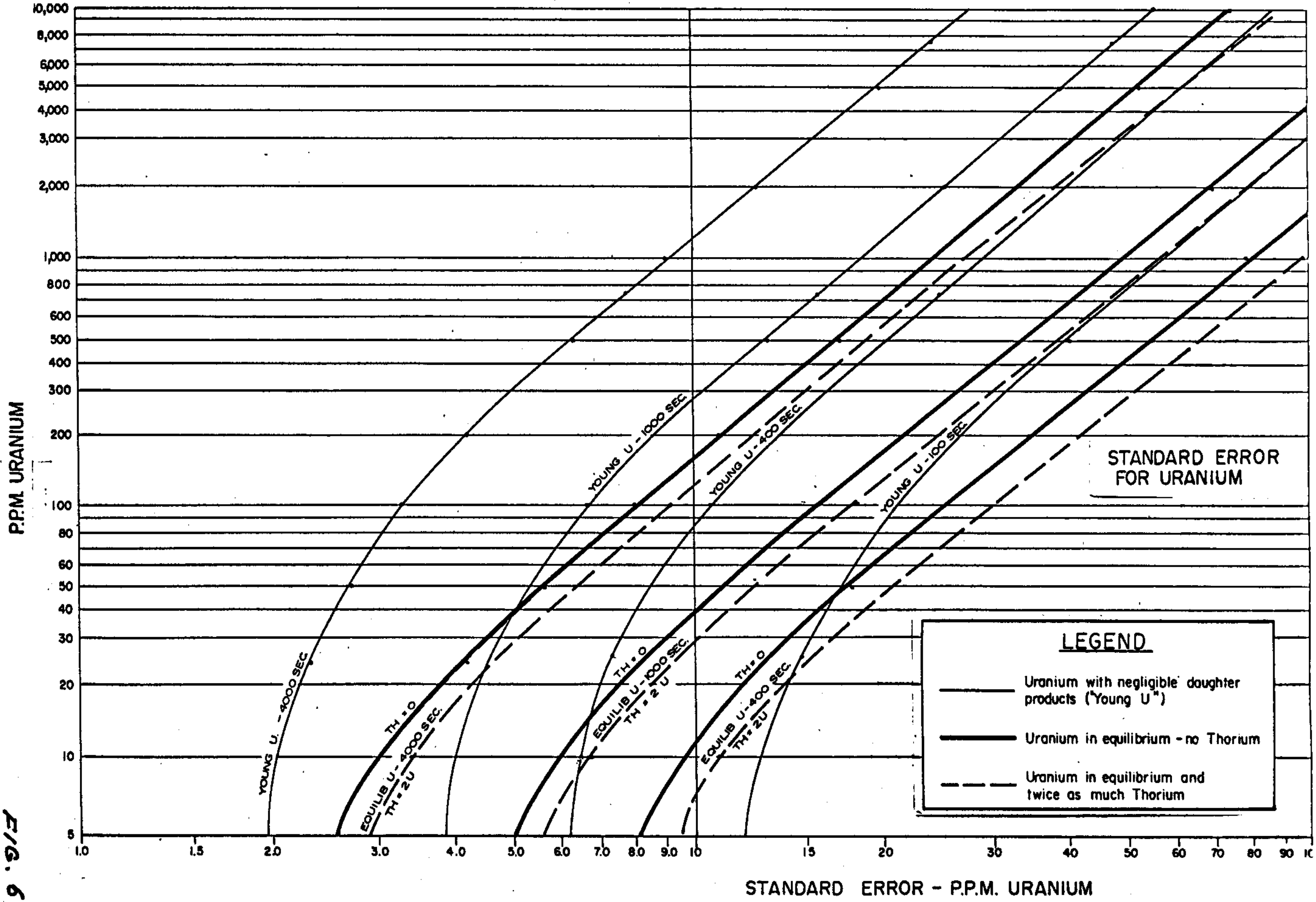
In statistical theory, the standard error (expected standard deviation) of a number produced by counting events is very close to the square root of that number. In practice, this is the controlling factor in precision for routine analysis by the LEGS technique, with other factors such as sample reloading differences and long term drift having little additional influence. This has the practical result of allowing quite accurate calculation of a standard error for each analysis, given the count on each of the spectrum channels monitored. Standard error curves for uranium and Pb^{214} in a variety of circumstances are shown in Figures 6 and 7 assuming a typical background radiation level and a sample density of 1 gm/cc.

Limitations

1. The main limitation of the LEGS technique in exploration geochemistry (at least with the present small crystal size) depends on the definition of "anomaly". If a few ppm is considered significant and Pb^{214} cannot substitute for uranium, then the lengthy counting times involved make another approach more applicable. Figure 6 shows the relationship of counting time to precision.

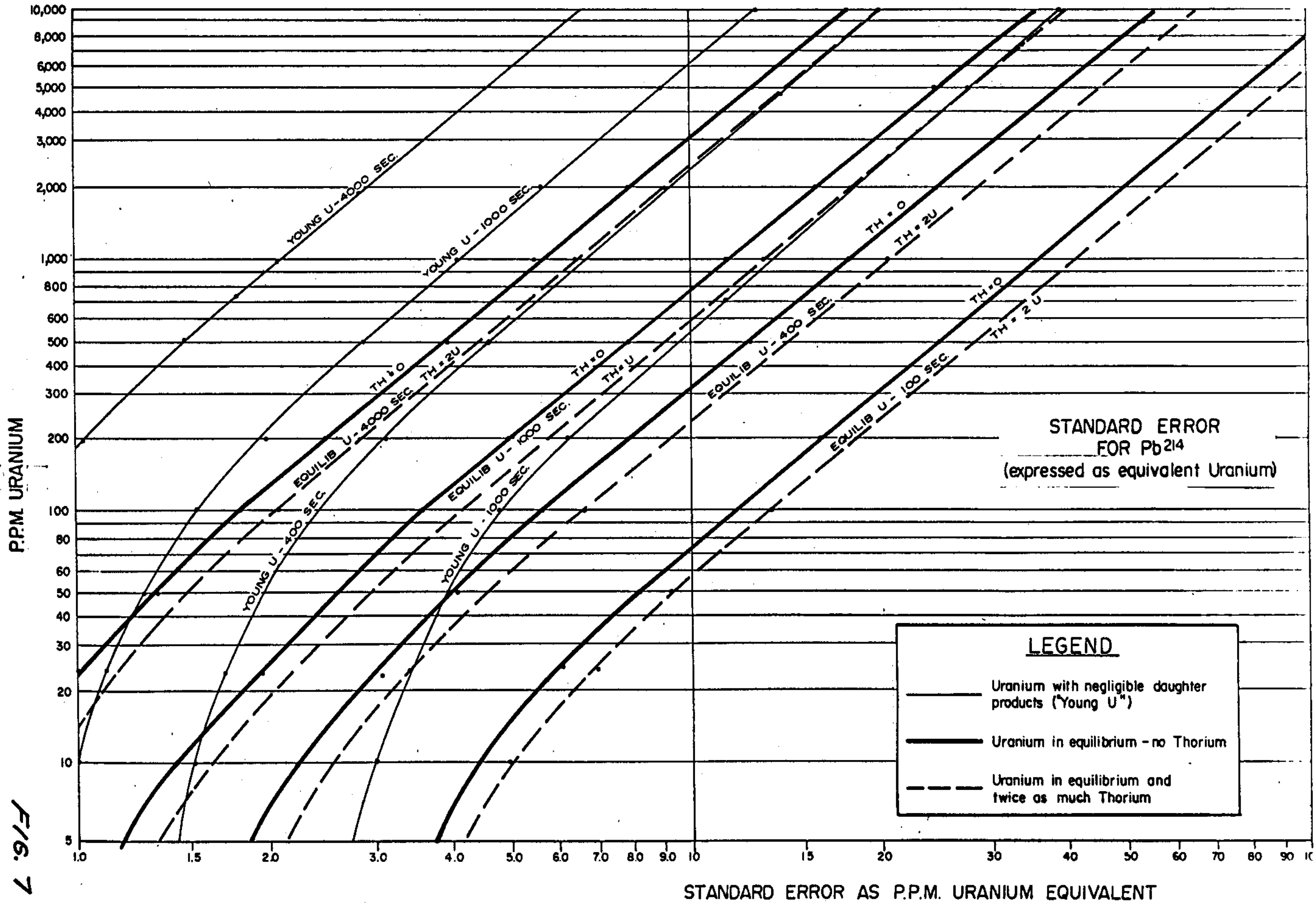
N. A. Vs. LAB. URANIUM P.P.M.





STANDARD ERROR
FOR URANIUM
P.P.M. URANIUM
STANDARD ERROR - P.P.M. URANIUM
10,000
8,000
6000
5,000
4,000
3,000
2,000
1,000
800
600
500
400
300
200
100
80
60
50
40
30
20
10
5
1.0
1.5
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10
15
20
30
40
50
60
70
80
90
YOUNG U. - 4000 SEC.
YOUNG U - 1000 SEC.
YOUNG U - 400 SEC.
YOUNG U - 100 SEC.
TH = 0
EQUILIB U - 4000 SEC.
TH = 2U
EQUILIB U - 1000 SEC.
EQUILIB U - 400 SEC.
LEGEND
Uranium with negligible daughter products ("Young U")
Uranium in equilibrium - no Thorium
Uranium in equilibrium and twice as much Thorium

FIG. 6

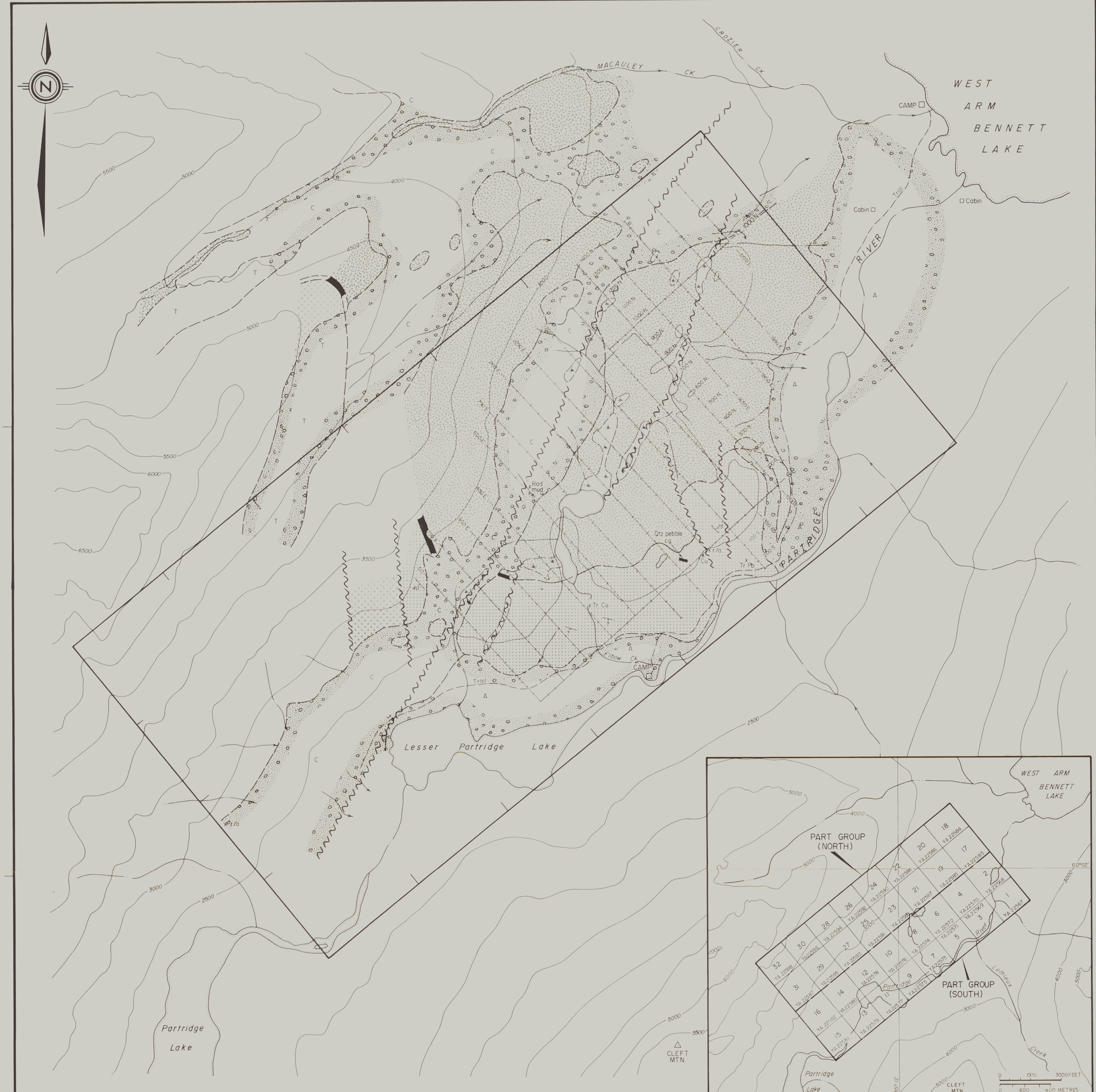


STANDARD ERROR FOR Pb214
(expressed as equivalent Uranium)
P.P.M. URANIUM
STANDARD ERROR AS P.P.M. URANIUM EQUIVALENT
10,000
8,000
6,000
5,000
4,000
3,000
2,000
1,000
800
600
500
400
300
200
100
80
60
50
40
30
20
10
5
1.0
1.5
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10
15
20
30
40
50
60
70
80
90
YOUNG U-4000 SEC.
YOUNG U - 1000 SEC.
YOUNG U - 400 SEC.
YOUNG U - 1000 SEC.
EQUILIB U - 4000 SEC.
EQUILIB U - 1000 SEC.
EQUILIB U - 400 SEC.
EQUILIB U - 100 SEC.
TH = O
TH = 2U
TH = O
TH = U
TH = O
TH = 2U
TH = O
TH = 2 U
LEGEND
Uranium with negligible daughter products ("Young U")
Uranium in equilibrium - no Thorium
Uranium in equilibrium and twice as much Thorium

FIG. 7

2. The very heavy elements tend to absorb radiation in the lowest energy channel. Where high uranium or thorium contents are involved, an interval correction for this effect is easily made. The only element likely to be a problem, therefore, is lead, with which 1,000 ppm gives roughly a 0.5% reduction in counts for that channel. This is likely to be a limitation only in working with certain ores.

3. Although thorium should, in theory, remain fairly close to equilibrium throughout its short decay sequence, cases of apparent thorium disequilibrium have been observed. This may cause problems in weathered, thorium-rich rocks, and is under investigation.



LEGEND

RECENT
- Alluvium, colluvium, glacial drift
  - A = Alluvium
  - T = Open talus
  - C = Colluvium; tree covered areas (bad bush)

? Partridge Lk. Fm. – Eocene
- Partly welded ignimbrite, maybe part of Macauley Creek Fm.
- Ignimbrite, rhyolite; black to grey; partly welded; fine to coarse; contains some volc. breccia and rhyolite lapilli tuff

- Basal conglomerate

Upper Cretaceous – Lower Tertiary
- Shattered pink quartz monzonite

- Geological contact (defined, approximate)
- Lineament (air photo)
- x Cu — Mineralization showing
- x r/a — Radiactive occurrence
- Trail
- Swamp
- Claim perimeter (taken from Gov't. map)
- Control grid; stations @ 50 m., lines @ 150 m.

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — R. R. CULBERT

FIG. 2

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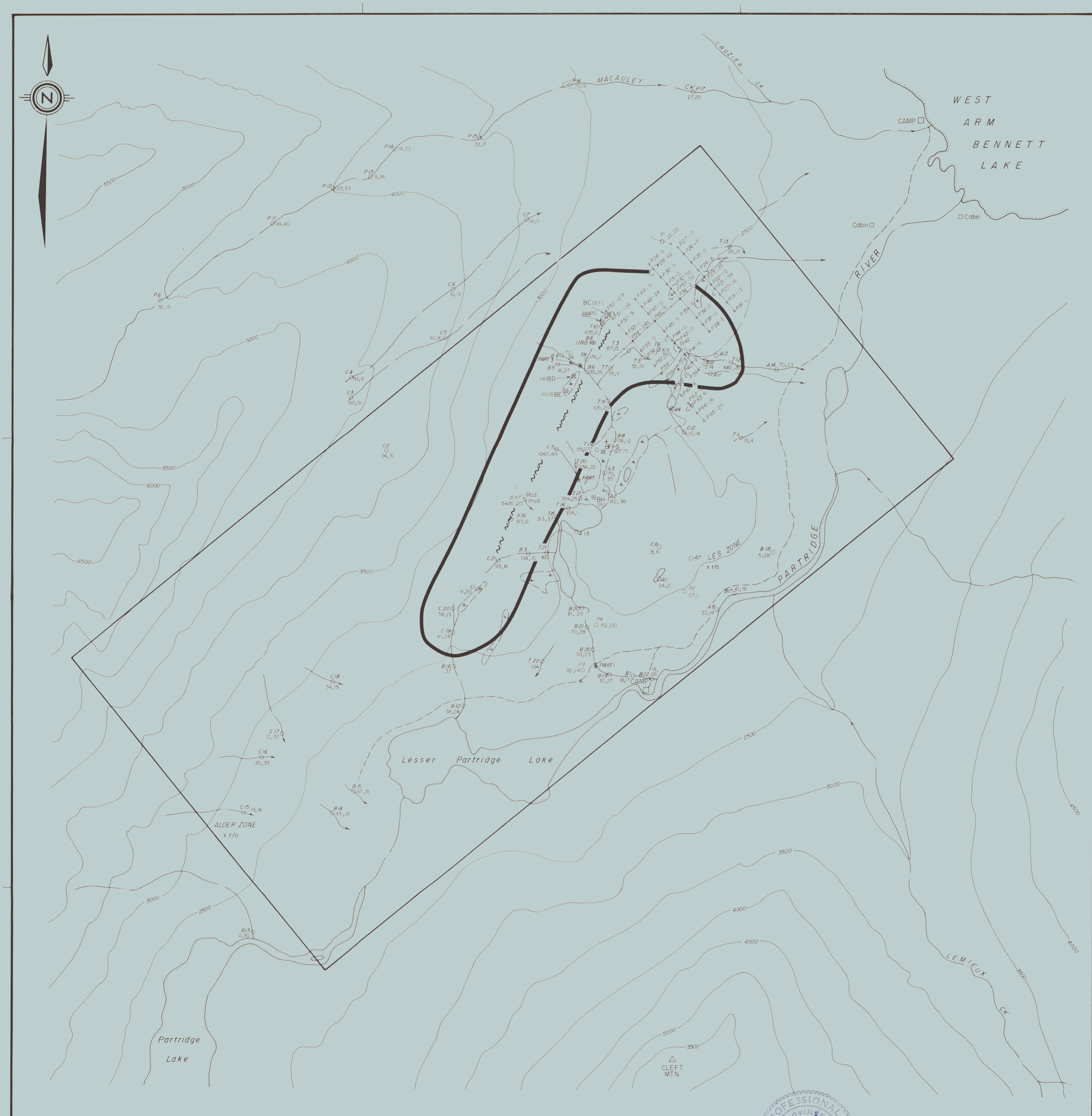
PART PROPERTY
GEOLOGY

m. 200 100 0 200 400 600 m.

PROJECT	PROJECT No.	SCALE	DATE
BENNETT	107	1 : 10,000	NOV. – 1978



LEGEND

- P10 ○ Silt sediment location, sample number
  - P = J. Pay sample
  - B = R. Bilquist sample
  - A = L. Allen sample
  - C = D. Culbert sample
- ○ 212,42 Uranium p.p.m., Thorium p.p.m.
- ⊠ BE Auger hole, hole number (with maximum value)
- P17 P18 Soil sample location (on line grid)
- x r/a Radioactive occurrence
- Swamp areas
- Claim outline ; corner post
- * Heavy mineral sample

FIG. 3

D.G. LEIGHTON & ASSOCIATES LTD.

PART PROPERTY

GEOCHEMISTRY

m. 200 100 0 200 400 600 m.

PROJECT	PROJECT No.	SCALE	DATE
BENNETT	107	1:10,000	NOV - 1978