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1986/86. Major, trace and REE chemistry of Eocambrian-Cambrian basaltic suites from the Dundas Trough and Smithton Basin, western Tasmania.

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Abstract

Major, Trace and Rare Earth Element (REE) chemistry are presented for twenty-one basaltic samples from three different lava phases formed during Eocambrian-Cambrian times. The analyses can be used to characterise the different basaltic phases such that they can be used as stratigraphic marker horizons within the mineralised successions of the Dundas Trough.

INTRODUCTION

Within the Crimson Creek Formation in the Dundas Trough, and correlates in the Smithton Basin, olivine and pyroxene/plagioclase phyric tholeiitic basalts occur. Intruding the Crimson Creek Formation in the Dundas Trough is a suite of high-magnesium andesitic lavas, which in turn, are intruded and overlain, in the Heazlewood River area, by a phase of low-titanium tholeiitic basalts. In the Black Hill area, the low-titanium tholeiitic basalt interdigitates with the Red Lead Conglomerate, a formation near the base of the Dundas Group with a middle-Middle Cambrian age. In the Cleveland area, low-titanium tholeiite lavas occur as fault-bounded blocks. These three basaltic groups can be distinguished both chemically, and by field criteria (Brown, 1986).

Analysis of whole rock samples for major and trace element chemistry was done for A. V. Brown by the Department of Mines Chemical Laboratory, Launceston.

Analysis of Rare Earth Elements (REE) of representative samples from the three basaltic suites was undertaken by H. M. Waldron at the Geology Department of the University of Melbourne.

Major and trace element analyses of the selected samples are listed in Table 1. REE analyses are listed in Table 2. Plots of REE patterns are included as Figures 1-7, with Figure 8 being a comparison diagram for all the suites from both the Dundas Trough and Smithton Basin. This report updates and supersedes Unpublished Report 1985/37.

Representative samples are as follows:

- (1) Pyroxene/plagioclase phyric tholeiitic basalt samples from the extended type area of the Eocambrian Crimson Creek Formation in the Mt Lindsay area. Department of Mines registered numbers 85-0001, 85-0002, 85-0004 (Table 1, No. 1-3; Table 2, No. 1-3; fig. 1).
- (2) Pyroxene/plagioclase phyric tholeiitic basalt samples from an area of Crimson Creek Formation correlates in the Cleveland area: 'Deep Creek Volcanics', University of Tasmania registered numbers 48302, 48332, 48333, in Collins (1983). Samples provided by P. L. F. Collins (Table 1, No. 4-6; Table 2, No. 4-6; fig. 2).

- (3) Olivine and pyroxene/plagioclase phyric tholeiitic basalt samples from correlates of the Crimson Creek Formation in the Smithton Basin.
 - (a) Olivine phyric samples: Department of Mines registered numbers 85-0081, 85-0082, 85-0083 (Table 1, No. 7-9; Table 2, No. 7-9, fig. 3).
 - (b) Pyroxene/plagioclase phyric samples: Department of Mines registered numbers 85-0078, 85-0079, 85-0080, 85-0084 (Table 1, No. 10-13; Table 2, No. 10-13; fig. 4).
- (4) Low-titanium tholeiitic basalt samples associated with middle-Middle Cambrian Dundas Group successions in the Black Hill-Serpentine Hill area. Department of Mines registered numbers 85-0032, 85-0033, 85-0034 (Table 1, No. 14-16; Table 2, No. 14-16; fig. 5).
- (5) Low-titanium tholeiitic basalt samples from the Heazlewood River area. University of Tasmania registered numbers 60900, 60903, 60909, in Creenaune (1980). Samples provided by P. J. Creenaune. (Table 1, No. 17-19; Table 2, No. 17-19; fig. 6).
- (6) High-magnesian andesite samples from the Magnet-Cleveland area. Department of Mines registered numbers 85-0023, 85-0025. (Table 1, No. 20-21; Table 2, No. 20-21; fig. 7).

RESULTS

The whole rock, trace element and REE chemistry shows that each phase has a characteristic pattern irrespective of which area in western Tasmania the samples come from.

Detailed geological data on the lavas and geochemical comparison diagrams can be found in Brown (1986). Preliminary interpretation of the lava suites and a suggested possible tectonic setting can be found in Brown and Waldron (1982a, 1982b).

REFERENCES

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COLLINS, P. L. F. 1983. *Geology and mineralisation at the Cleveland mine, western Tasmania.* Ph.D. thesis, University of Tasmania : Hobart.

CREENAUNE, P. J. 1980. *The volcanics of the Heazlewood River complex.* B.Sc.(Hons) thesis, University Tasmania : Hobart.

[22 December 1986]

Table 1. CHEMICAL ANALYSES : MAJOR AND TRACE ELEMENTS

	1	2	3	4	5	6	7	8	9	10	11	12
Reg. no.	85-0001	85-0002	85-0005	48302	48332	48333	85-0081	85-0082	85-0083	85-0078	85-0079	85-0080
SiO ₂	47.50	45.60	46.94	45.35	49.80	47.81	45.87	46.89	47.03	47.23	48.20	48.44
TiO ₂	2.00	2.40	2.03	2.56	1.73	3.76	0.66	0.68	0.67	1.67	2.35	2.32
Al ₂ O ₃	12.70	12.20	12.87	13.29	14.47	12.64	14.44	14.48	14.76	14.27	13.66	13.25
Fe ₂ O ₃	4.70	1.70	5.38	4.83	0.60	2.84	3.68	3.18	2.71	5.23	5.38	5.57
FeO	9.40	11.50	9.31	11.30	11.69	12.70	6.04	6.27	6.72	7.18	7.86	7.71
MnO	0.25	0.24	0.26	0.25	0.20	0.28	0.19	0.17	0.16	0.18	0.19	0.21
MgO	5.30	8.50	5.57	6.25	6.57	5.53	10.67	10.04	10.11	6.51	5.73	6.43
CaO	8.90	10.90	9.08	10.58	9.09	8.54	9.95	10.30	9.87	11.24	10.49	8.08
Na ₂ O	3.50	1.00	3.45	3.31	3.12	3.10	2.61	2.70	2.13	2.28	2.51	3.27
K ₂ O	0.07	0.67	0.07	0.20	0.94	0.46	0.14	0.15	0.63	0.22	0.36	0.12
P ₂ O ₅	0.23	0.26	0.26	0.30	0.17	0.78	0.16	0.16	0.17	0.20	0.29	0.25
CO ₂ ⁺	0.12	0.10	0.36	ND	ND	ND	0.08	0.04	0.07	0.15	0.09	0.08
H ₂ O ₋	3.60	3.20	3.57	2.30*	2.50*	2.42*	4.62	4.32	4.20	2.79	2.64	3.57
H ₂ O	0.60	0.40	0.43	ND	ND	ND	0.23	0.22	0.26	0.29	0.14	0.26
Total	98.87	98.67	100.06	100.52	100.88	100.86	99.34	99.40	99.49	99.44	99.89	99.54
Mg*	40.9	53.8	41.2	41.6	48.9	39.2	67.0	66.2	66.3	49.4	44.6	47.4
Cr	94	439	60	92	50	50	952	777	767	260	161	161
Ni	72	192	59	65	55	28	297	226	230	92	88	85
Zr	127	210	125	162	95	187	72	72	65	97	144	139
Y	31	31	29	46	30	76	15	15	18	23	23	22
Nb	11	28	10	15	8	21	15	13	13	7	15	15
Rb	7	24	<4	7	132	48	<4	<4	9	<4	9	4
Sr	60	295	59	620	339	209	566	532	140	290	245	293
Ba	196	287	143	121	252	89	ND	ND	ND	240	ND	ND
V	410	250	410	415	399	449	ND	ND	ND	ND	ND	ND
Sc	43	30	34	ND	ND	ND	ND	ND	ND	ND	ND	ND
Co	51	41	41	ND	ND	ND	ND	ND	ND	45	ND	ND

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Table 1. (continued)

	13	14	15	16	17	18	19	20	21
Reg. no.	85-0084	85-0032	85-0033	85-0034	60900	60903	60919	85-0023	85-0025
SiO ₂	47.74	57.10	52.20	57.30	51.72	48.88	49.56	51.20	53.40
TiO ₂	1.56	0.28	0.57	0.42	0.25	0.13	0.25	0.07	0.09
Al ₂ O ₃	13.96	12.90	17.40	12.90	14.69	14.41	14.73	8.40	10.30
Fe ₂ O ₃	4.70	5.00	2.00	2.10	3.59	2.90	3.17	2.40	1.90
FeO	7.94	7.50	6.90	6.40	6.67	5.89	6.68	6.80	6.80
MnO	0.20	0.13	0.09	0.14	0.18	0.22	0.18	0.17	0.24
MgO	6.66	4.40	3.90	4.60	8.91	9.99	10.49	17.10	10.70
CaO	10.46	7.60	3.30	4.40	9.73	13.48	11.72	4.60	3.40
Na ₂ O	2.45	1.60	1.40	2.90	2.24	1.70	1.44	0.36	0.05
K ₂ O	0.56	0.19	2.70	0.19	0.61	0.80	0.56	0.06	0.77
P ₂ O ₅	0.20	0.04	0.06	0.05	0.03	0.01	0.04	0.01	0.04
CO ₂ +	0.28	0.05	3.60	3.70	ND	ND	ND	0.49	6.00
H ₂ O ₋	2.77	2.40	4.60	4.00	1.64	2.00	1.71	6.60	5.40
H ₂ O	0.10	0.35	0.37	0.36	ND	ND	ND	1.20	0.99
Total	99.58	99.54	99.09	99.46	100.26	100.41	100.53	99.46	100.08
Mg*	49.4	39.5	44.4	49.7	61.6	67.7	66.2	77.3	69.1
Cr	169	24	185	139	ND	ND	ND	860	814
Ni	87	58	81	70	83	105	172	687	161
Zr	93	8	16	14	11	7	15	6	16
Y	20	8	11	9	16	7	14	7	5
Nb	5	<4	<4	<4	ND	1	2	<4	<4
Rb	4	6	78	6	7	19	7	<4	47
Sr	210	49	40	64	91	49	36	10	39
Ba	ND	41	439	44	ND	ND	ND	39	47
V	ND	260	490	230	262	167	21	97	110
Sc	ND	47	57	44	ND	ND	ND	26	25
Co	ND	29	36	23	ND	ND	ND	ND	ND

Registered numbers of samples 4-6 and 17-19 are University of Tasmania numbers.

Samples 4-6 from Collins (1983)

Samples 17-19 from Creenaune (1980)

* = loss on ignition. ND = not determined. Mg* = 100 Mg/(Mg+Fe⁺) Fe⁺ = Total Fe as FeO.

Table 2.

Reg. no.	La	Ce	Nd	Sm	Eu	Gd	Tb	Ho	Tm	Yb	Lu	
1	85-0001 *	11.03	26.66	15.78	4.69	1.68	5.56	0.89	1.24	0.42	3.31	0.50
2	85-0005 *	10.87	27.09	16.55	4.74	1.67	5.52	1.03	1.29	0.46	3.44	0.55
3	85-0002 *	24.99	54.75	27.00	6.63	1.86	6.33	1.10	1.34	0.47	3.03	0.45
4	48332 (#) +	8.54	22.15	13.40	3.98	1.45	4.92	0.91	ND	ND	3.27	0.46
5	48302 (#) +	13.97	36.55	21.98	6.04	1.96	6.82	1.26	ND	ND	4.38	0.66
6	48333 (#) +	21.09	49.35	26.35	7.50	2.64	9.72	ND	ND	ND	6.07	0.85
7	85-0081 *	13.04	27.92	11.89	2.57	0.76	2.57	0.44	0.76	0.34	2.53	0.42
8	85-0082 *	13.74	29.12	12.36	2.71	0.79	2.82	0.56	0.86	0.37	0.45	0.37
9	85-0083 *	12.67	26.85	12.55	2.54	0.74	2.67	0.51	0.75	0.40	2.59	0.42
10	85-0078 *	7.26	18.01	12.11	3.84	1.41	4.60	0.84	1.22	0.40	2.81	0.43
11	85-0084 *	8.13	19.89	12.51	3.78	1.38	4.16	0.70	0.97	0.35	2.61	0.38
12	85-0079 *	14.73	35.36	20.48	5.22	1.74	5.54	0.90	0.99	0.40	2.49	0.37
13	85-0080 *	15.36	36.71	22.20	5.34	1.60	5.54	0.98	1.10	0.39	2.50	0.38
14	85-0032 *	0.22	0.81	0.99	0.42	0.13	0.80	0.18	0.35	0.21	1.55	0.28
15	85-0033 *	(0.97)	3.02	1.95	0.66	0.30	1.27	0.28	0.51	0.21	2.02	0.34
16	85-0034 *	0.26	0.80	1.22	0.62	0.25	1.07	0.25	0.53	0.28	2.16	0.39
17	60900 (#) *	0.18	0.49	0.73	0.43	0.18	0.95	0.21	0.43	0.23	1.63	0.28
18	60903 (#) *	(0.50)	0.87	0.84	0.49	0.24	1.10	0.25	0.47	0.27	1.85	0.32
19	60919 (#) *	(0.24)	0.40	0.44	0.25	0.14	0.56	0.12	0.26	0.14	0.98	0.17
20	85-0023 *	1.38	2.34	1.22	0.37	0.14	0.54	0.13	0.23	0.12	0.81	0.12
21	85-0025 *	4.67	9.37	3.62	0.67	0.19	0.67	0.13	0.16	0.09	0.69	0.12

Values in ppm

Values in brackets indicate anomalous values

(#) indicates University of Tasmania registered numbers

* indicates RNAA

+ indicates INAA

Analyses by H.M. Waldron, Geology Department, University of Melbourne.

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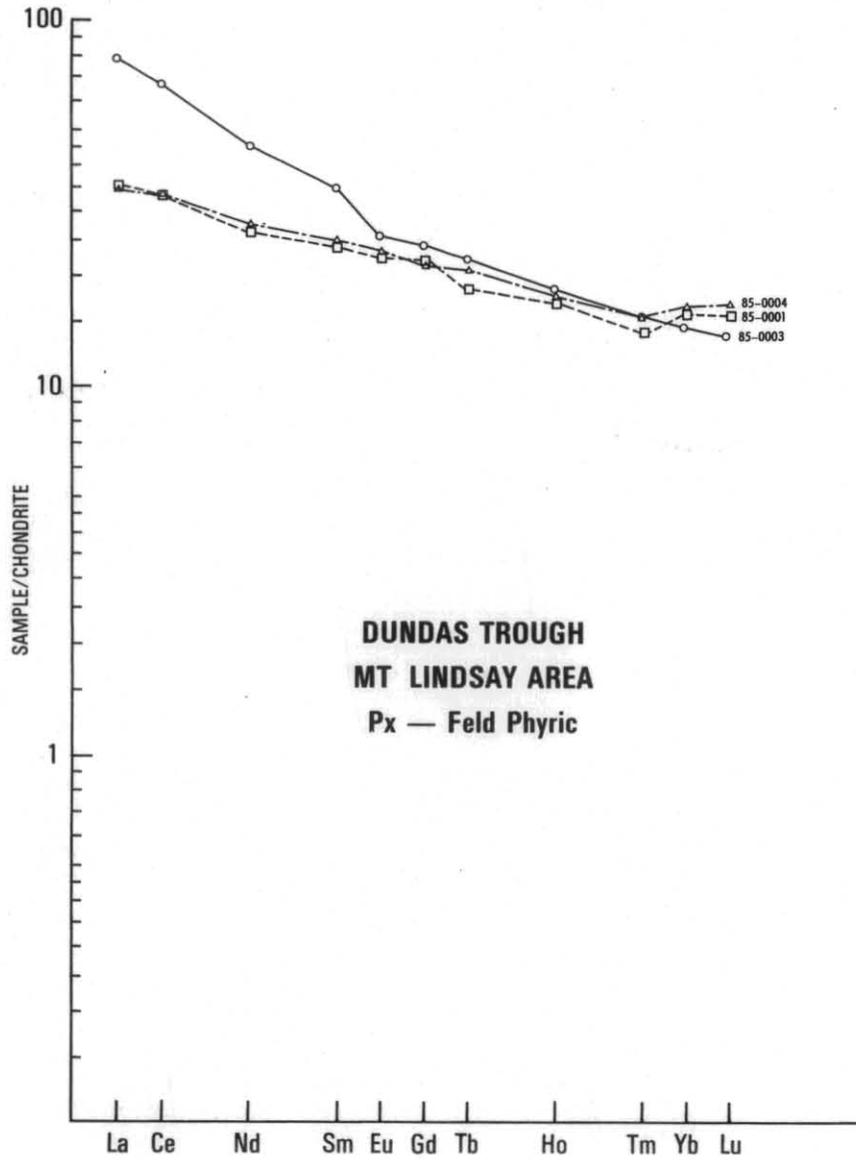


Figure 1.

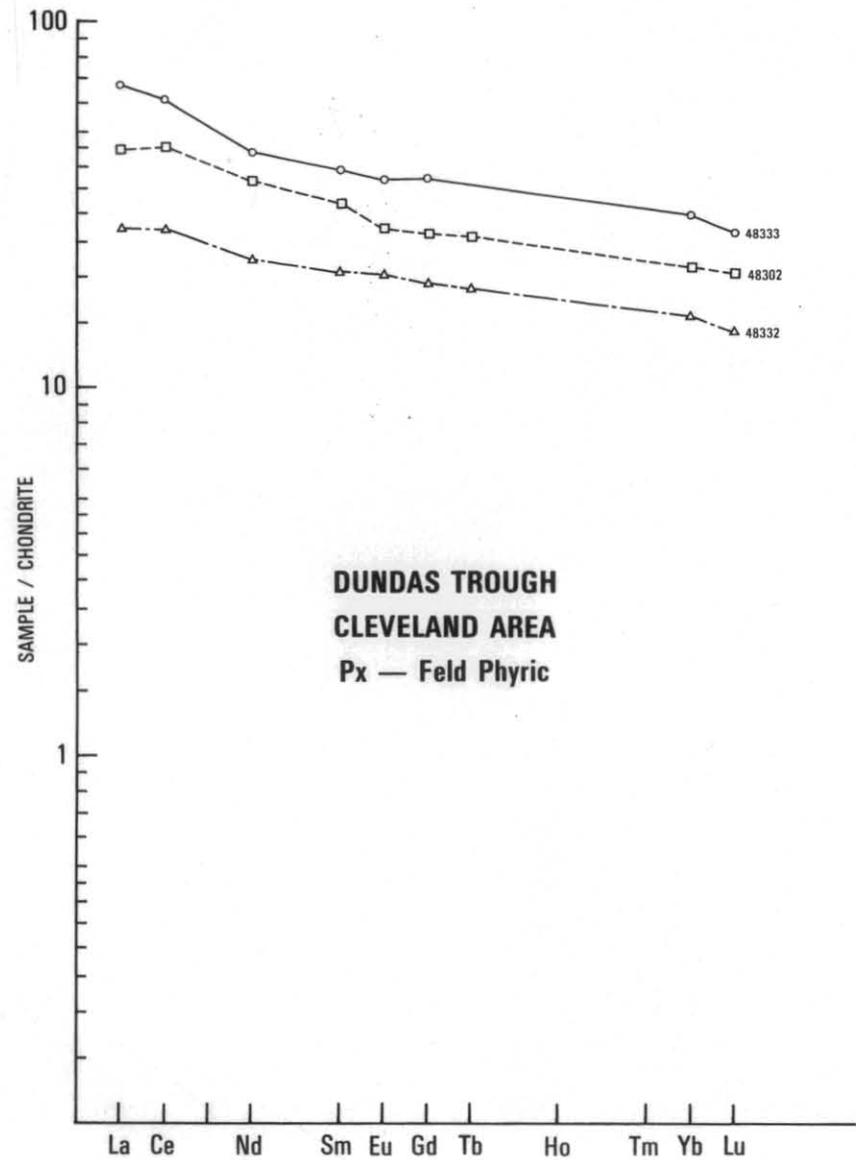
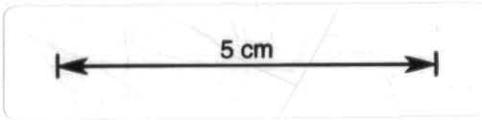


Figure 2.

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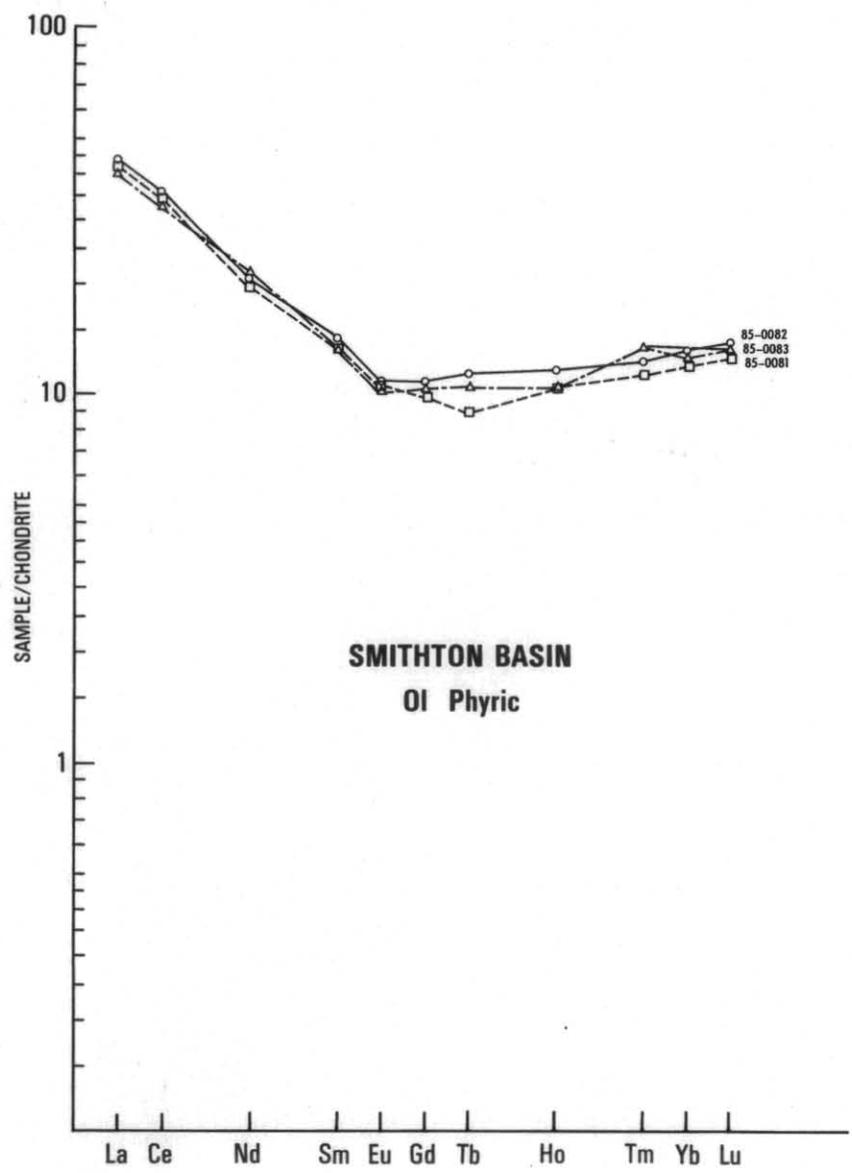


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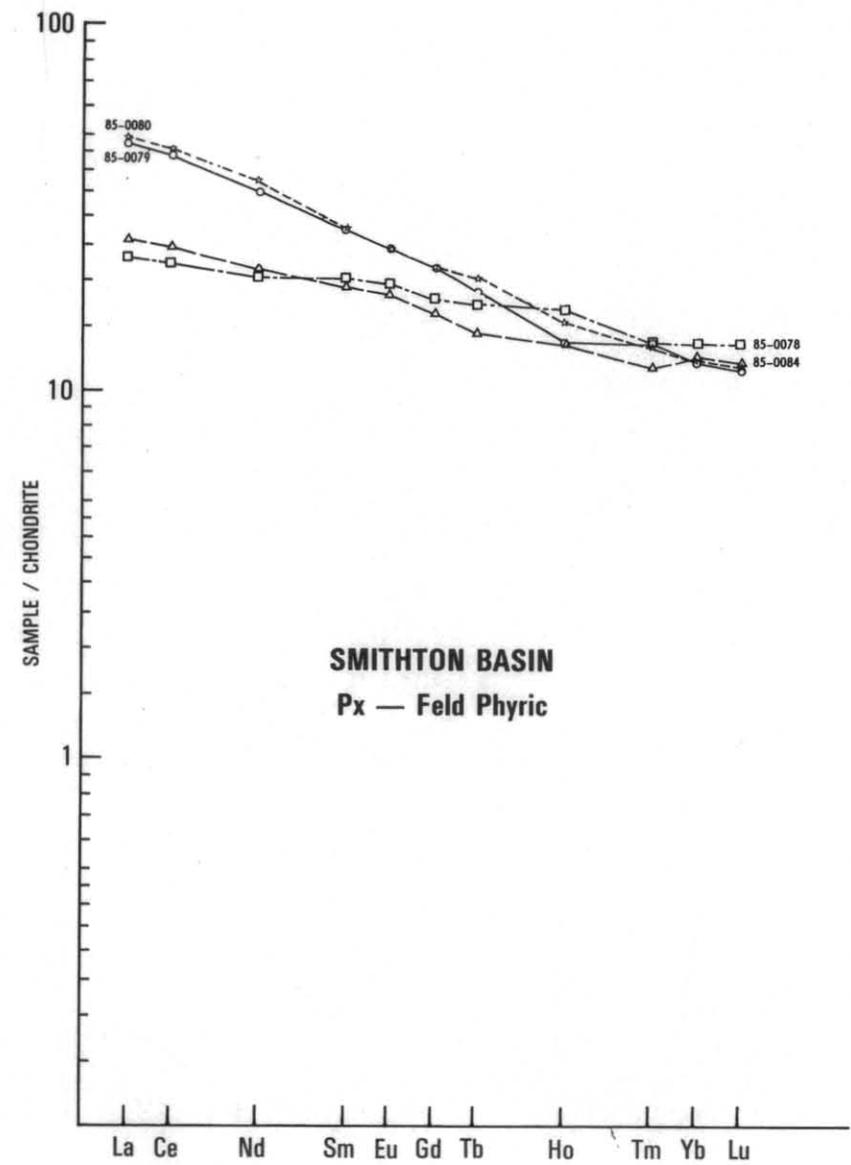
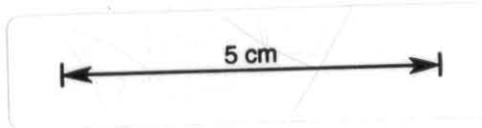


Figure 4.

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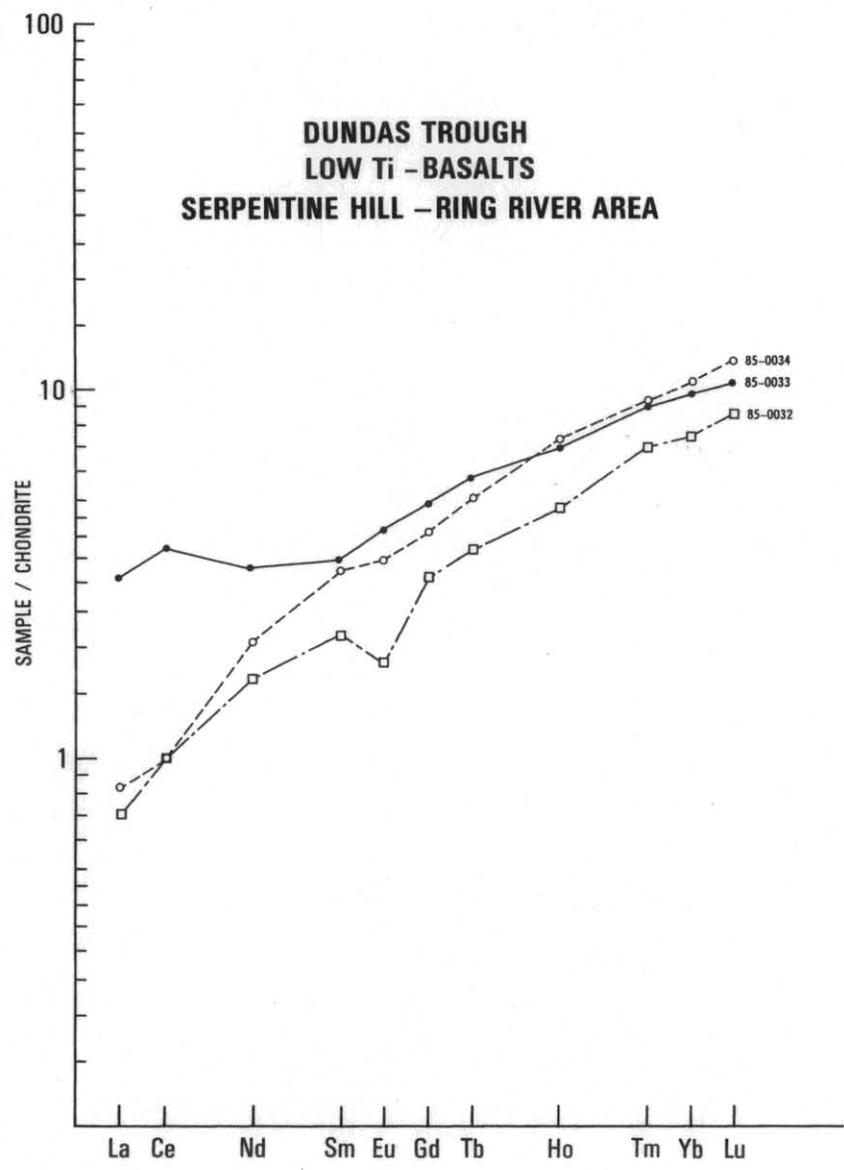


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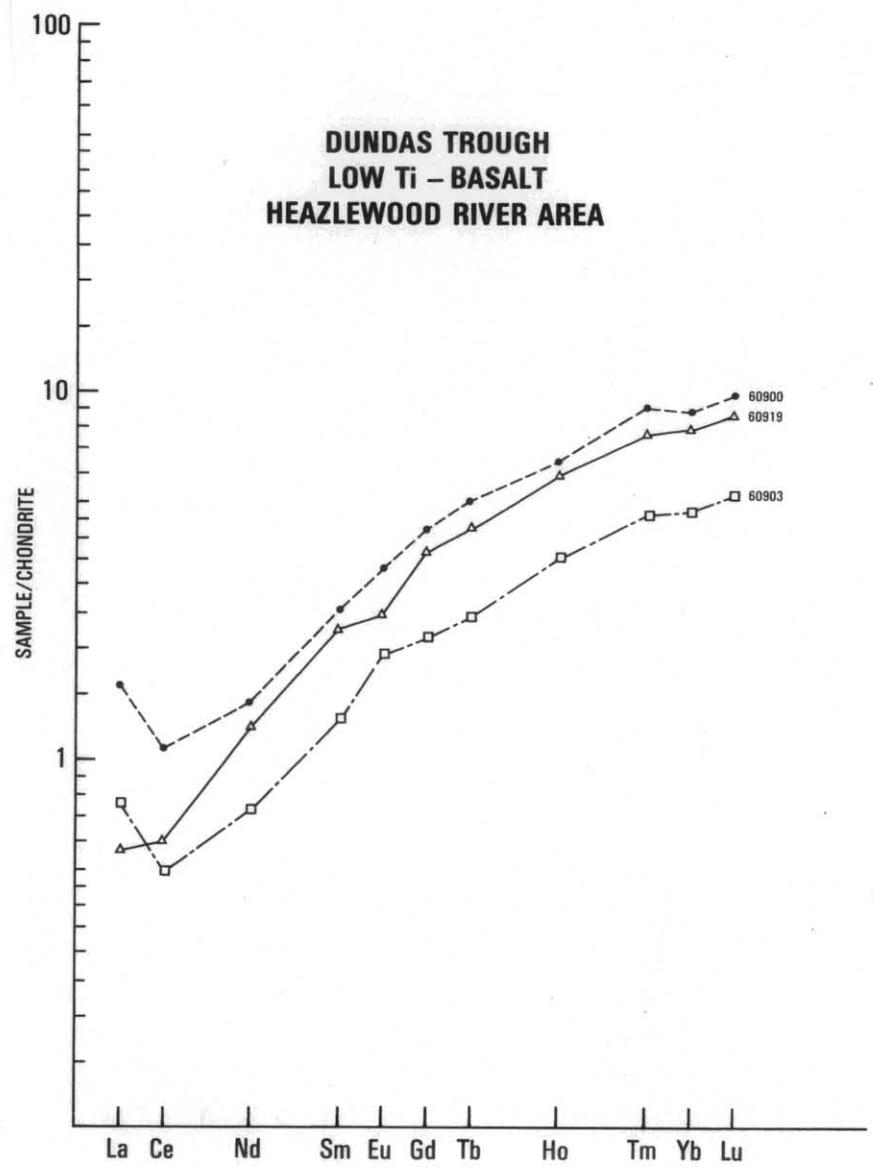
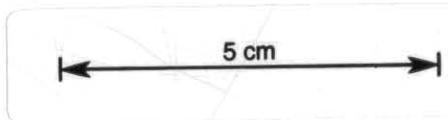


Figure 6.

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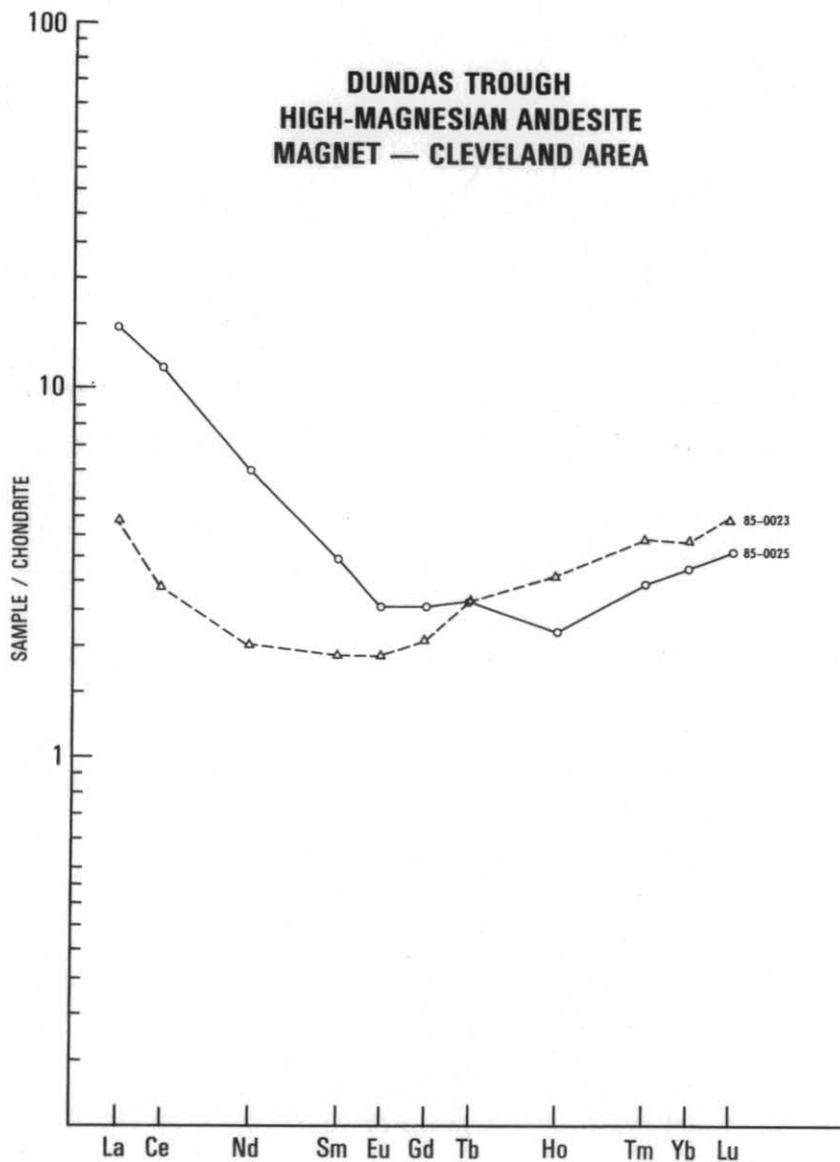


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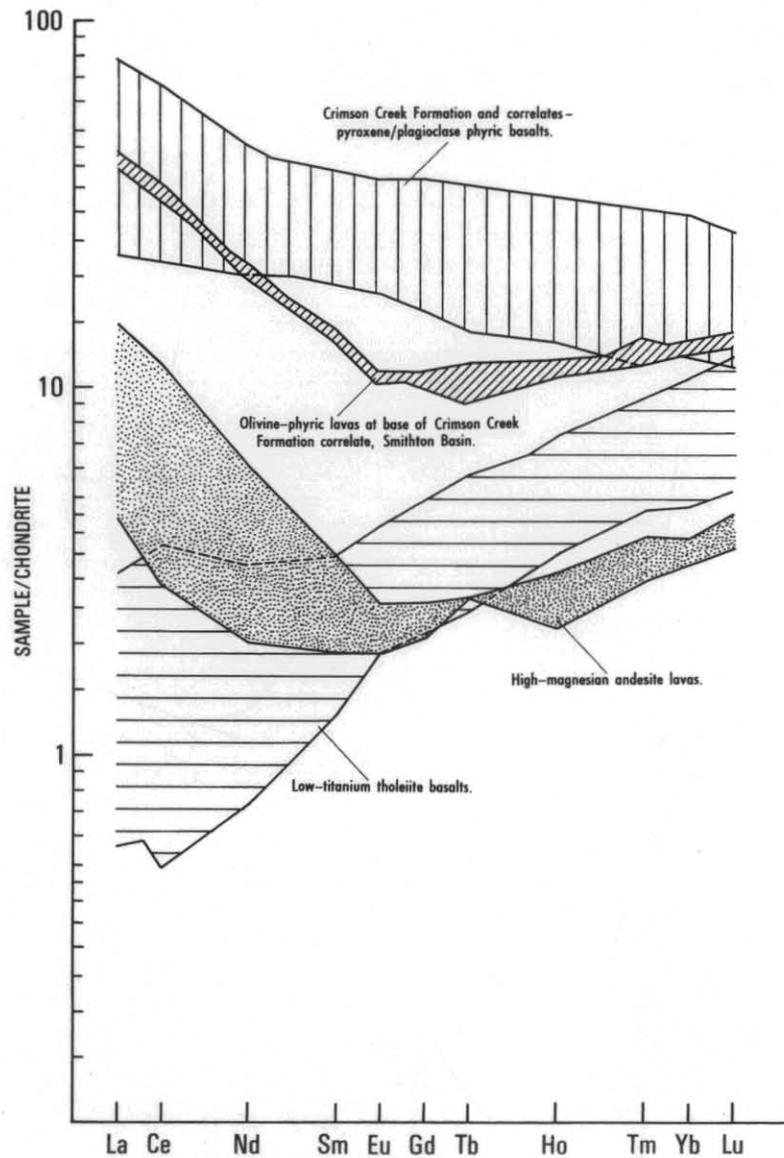
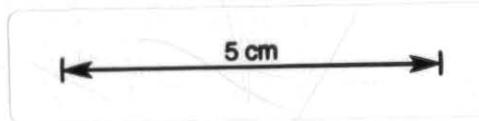


Figure 8. Comparison of fields of chondrite normalised REE patterns for different basaltic phases.