CHAPTER V

GEOCHEMISTRY

Introduction

A total of 65 basalt samples, a combination of 10 samples from the Nam Cho basalt and 55 samples from the Sop Prab - Ko Kha basalt, were chemically analysed for their major and some trace elements. In addition, 5 samples from the Nam Cho basalt and 25 samples from the Sop Prab - Ko Kha basalt have been selected from those 65 samples to determine for some rare earth elements. The major and trace elements were mainly analysed by X-ray fluorescence (XRF) method, whereas rare earth elements were analysed by neutron activation analysis (NAA) technique. Almost analytical methods are descriptively concluded in the Appendices. The major element oxides of these basalt samples were computed for CIPW normative values by using "NEWPET" computer software program created by Geological Survey of Canada (Table 5.2).

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Major Element Data

The major elements of the basalt samples analyzed (Table 5.1), include SiO_2, Al_2O_3, Fe_2O_3, FeO, CaO, MgO, Na_2O, K_2O, TiO_2, MnO, and P_2O_5. Averages of these major elements of each basaltic flow from the Nam Cho and the Sop Prab-Ko Kha areas are concluded in Table 5.3. Detail of individual oxides are present below:

Table 5.1 Major element analyses (in percent) of 65 basalt samples for the Nam Cho and the Sop Prab-Ko Kha basalts.

SAMPLE	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	K_2O	TiO_2	MnO	P_2O_5	H_2O	LOI	TOTAL	$Mg^{\#}$
S-2	49.22	16.53	5.90	3.05	7.77	5.99	2.88	1.36	1.93	0.12	0.70	0.78	2.38	95.45	77.78
S-4	48.22	17.39	6.07	1.96	7.63	4.90	2.25	1.98	2.01	0.13	0.85	0.61	5.11	93.39	81.67
S-8	49.00	17.78	4.92	3.19	7.48	4.22	2.79	2.71	2.12	0.13	0.86	0.74	2.95	95.20	70.22
S-11	49.48	17.80	5.32	2.78	7.36	4.54	3.26	1.37	2.14	0.12	0.88	0.66	3.53	95.05	74.43
S-13	49.32	17.69	4.72	3.26	7.27	4.63	3.50	1.24	2.11	0.12	0.85	0.48	3.45	95.01	71.68
S1-1	49.24	17.03	3.95	4.67	7.67	5.42	2.57	2.98	2.05	0.21	0.74	0.45	1.92	96.53	67.41
S1-7	48.63	16.45	6.76	3.36	8.41	5.11	2.12	2.48	1.99	0.18	0.62	0.35	2.40	96.11	73.05
S1-10	47.15	16.07	3.83	5.32	9.23	6.87	1.97	2.19	2.01	0.15	0.64	0.52	2.98	95.43	69.71
S1-13-2	46.18	16.08	3.33	6.31	8.48	7.76	2.40	1.83	2.06	0.17	0.70	0.56	2.88	95.30	68.67
S1-14	46.37	15.93	6.00	4.35	8.97	6.19	2.19	1.44	2.08	0.14	0.70	1.22	3.29	94.36	71.72
S7-2	48.25	17.60	4.78	3.64	7.85	4.32	2.49	1.91	2.11	0.13	0.83	0.80	4.25	93.91	67.90
S7-3-1	47.62	16.59	5.77	3.00	8.67	4.94	1.69	2.56	2.05	0.14	0.71	0.82	4.50	93.74	74.59
S7-5	46.08	15.82	3.51	5.52	9.61	6.85	1.58	2.10	1.94	0.14	0.61	0.61	4.44	93.76	69.27
S8-2	48.23	16.59	5.75	4.18	8.38	5.80	2.68	1.44	2.10	0.14	0.71	0.58	2.42	96.00	71.21
S8-5	46.89	15.99	6.34	3.73	8.75	5.54	2.49	0.62	2.14	0.17	0.78	1.32	3.95	93.44	72.58
S 18-2-1	49.17	18.13	5.88	2.44	7.34	4.52	3.09	1.53	2.11	0.12	0.91	1.08	3.31	95.24	76.75
S 18-3	48.72	17.83	5.79	2.54	7.47	5.01	2.06	3.35	2.11	0.12	0.85	0.67	2.91	95.85	77.85
S 18-5-2	47.75	17.44	3.08	4.58	8.17	5.75	2.10	3.66	2.01	0.12	0.85	0.46	3.55	95.51	69.11
S 18-7	47.85	16.70	4.96	4.41	8.69	5.73	2.39	2.80	2.00	0.14	0.67	0.55	2.31	96.34	69.84
S 18-11	47.62	16.60	2.92	6.25	8.14	7.20	2.38	2.30	1.95	0.15	0.69	0.72	2.47	96.20	67.25
S 19-1	48.40	17.45	5.00	3.24	7.66	5.16	1.74	2.90	2.00	0.13	0.80	0.96	4.12	94.48	73.95
S 19-3	49.46	17.95	4.88	3.25	7.39	4.65	3.22	1.94	2.00	0.12	0.87	0.92	2.82	95.73	71.83
S 19-5	47.44	16.90	4.80	3.47	8.55	5.98	2.20	2.02	1.96	0.13	0.77	1.05	3.98	94.22	75.44
S 19-7	48.64	16.76	5.55	3.96	8.27	5.70	1.85	2.73	1.94	0.14	0.67	0.88	2.26	96.21	71.95
S 19-9	47.14	16.09	2.86	6.42	8.47	7.08	1.72	2.83	1.93	0.15	0.63	0.57	3.72	95.32	66.28

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Table 5.1 (cont.)

SAMPLE	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	K_2O	TiO_2	MnO	P_2O_5	H_2O	LOI	TOTAL	$Mg^{\#}$
S 21-1	49.43	17.96	3.33	4.78	7.44	4.28	2.95	1.52	2.07	0.13	0.90	1.24	3.42	94.39	61.48
S 21-4-2	49.42	17.05	7.03	2.20	7.92	4.89	2.56	1.38	2.05	0.14	0.80	1.28	2.98	95.44	79.85
S 21-6	47.22	16.38	3.91	5.40	8.33	6.92	2.22	2.08	1.97	0.14	0.66	0.80	3.44	95.23	69.55
S 21-8	47.28	15.95	3.49	6.14	8.35	7.10	1.67	2.49	1.97	0.15	0.66	0.82	3.43	95.25	67.33
S 21-10	46.93	15.98	2.30	6.00	10.21	6.58	1.79	2.39	1.96	0.17	0.63	0.47	3.96	94.94	66.15
S 24-1	48.58	17.57	3.97	4.19	7.54	5.06	2.44	1.81	1.99	0.13	0.84	0.92	4.13	94.12	68.28
S 24-2	49.42	17.97	5.88	2.67	7.48	4.25	3.17	1.56	2.07	0.13	0.86	0.85	3.07	95.46	73.94
S 24-4	47.68	16.76	2.73	5.75	8.44	6.58	2.17	2.75	2.01	0.13	0.73	0.79	2.74	95.73	67.10
S 24-6	47.30	15.92	2.79	6.43	8.49	6.98	2.07	2.54	1.92	0.14	0.63	0.68	3.42	95.21	65.93
S 24-7	47.70	16.18	2.80	6.65	8.57	7.02	2.05	2.50	1.93	0.15	0.63	0.68	2.81	96.18	65.30
S 29-1	49.42	17.86	5.51	2.85	7.43	4.89	3.56	1.51	2.05	0.11	0.84	0.87	2.65	96.03	75.36
S 29-3	49.81	17.24	7.67	1.65	8.18	4.73	3.42	1.32	1.98	0.13	0.72	0.58	1.99	96.85	83.63
S 29-5	48.37	17.19	6.48	2.29	7.85	5.15	1.64	2.90	2.03	0.14	0.78	0.76	3.95	94.82	80.03
S 29-10	47.22	16.36	2.59	6.61	8.19	6.65	2.36	2.20	2.02	0.14	0.66	0.67	3.29	95.26	64.20
S 29-11	48.12	16.56	2.65	6.51	8.74	6.91	2.65	2.68	1.97	0.15	0.70	0.38	1.33	97.64	65.42
S2-2	46.60	16.29	5.92	4.19	8.54	5.92	2.69	1.29	2.16	0.15	0.79	1.47	2.95	94.54	71.58
S13-1	46.83	17.27	2.80	3.26	11.13	4.44	2.44	3.09	2.10	0.09	0.76	0.66	3.00	94.21	70.82
S6-2	45.72	15.80	6.79	2.72	9.10	7.65	1.63	2.69	2.05	0.16	0.66	0.60	3.31	94.97	83.37
S14-7	46.37	15.79	4.17	5.45	8.61	7.15	1.68	2.73	2.02	0.14	0.63	0.68	3.50	94.74	70.04
S12-6	45.81	16.22	2.23	7.16	8.73	7.40	2.42	2.99	2.13	0.16	0.65	0.55	2.32	95.90	64.81
S20-2	48.79	17.35	3.91	4.29	7.43	5.42	3.54	1.43	2.11	0.13	0.82	1.07	2.62	95.22	69.25
S14-1	46.45	16.84	5.03	2.88	8.05	5.40	1.47	2.87	1.99	0.13	0.79	1.09	5.82	91.90	76.97
S22-4-1	46.45	15.96	3.57	5.40	8.52	7.03	1.54	2.88	1.99	0.14	0.65	0.76	3.71	94.13	69.88
S25-4	46.81	15.95	2.72	6.71	8.25	6.90	2.15	2.47	1.99	0.14	0.59	0.61	3.46	94.68	64.70

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Table 5.1 (cont.)

SAMPLE	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	K_2O	TiO_2	MnO	P_2O_5	H_2O	LOI	TOTAL	$Mg^{\#}$
S23-4-1	47.81	16.46	2.18	5.73	9.52	7.27	1.83	2.51	2.07	0.19	0.63	0.40	2.99	96.20	69.34
S28-1	48.98	17.84	5.16	2.76	7.38	4.43	3.63	1.55	2.09	0.14	0.91	1.24	3.02	94.87	74.10
S25-2	48.92	17.36	6.23	2.70	7.81	4.94	2.67	3.23	2.10	0.13	0.76	0.64	1.68	96.85	76.53
S28-3	45.13	15.95	3.07	3.57	12.98	4.46	2.75	2.71	1.99	0.21	0.63	0.56	5.10	93.45	69.01
S28-4	46.97	16.22	2.97	6.25	8.34	6.70	2.18	2.38	1.98	0.14	0.64	0.74	3.34	94.77	65.64
S27-11	45.44	16.12	2.31	7.11	8.91	7.85	1.68	2.95	2.21	0.16	0.68	0.52	2.75	95.42	66.30
N-1	43.10	15.45	4.73	7.07	9.66	7.71	3.32	0.96	2.48	0.19	0.75	0.85	2.97	95.42	66.03
N-2	43.53	15.87	5.28	6.35	9.23	7.16	2.80	2.56	2.37	0.20	0.80	0.86	2.21	96.15	66.77
N-3	42.86	15.79	5.51	6.11	9.38	7.30	2.63	2.58	2.47	0.21	0.79	1.24	1.97	95.63	68.05
N-4	42.89	15.25	4.35	7.04	9.67	8.53	2.84	0.98	2.53	0.19	0.66	0.89	3.00	94.93	68.35
N-5	44.98	15.99	5.61	5.12	8.30	6.75	3.40	2.72	2.08	0.19	0.75	0.50	2.35	95.89	70.15
N-7	44.07	16.10	7.16	5.11	9.07	6.14	3.40	3.07	2.32	0.21	0.82	0.35	1.22	97.47	68.17
N-8	45.35	16.03	6.19	4.92	8.62	7.08	3.16	2.87	2.12	0.20	0.80	0.45	1.58	97.34	71.95
N-9	44.51	15.61	6.05	5.09	8.79	7.49	3.24	2.76	2.19	0.20	0.76	0.52	1.74	96.69	72.40
N-11	45.10	15.80	5.58	5.29	8.54	7.38	3.11	2.91	2.11	0.19	0.74	0.57	1.58	96.75	71.32
N-12	45.24	16.29	4.32	6.47	8.56	6.90	3.34	2.85	2.08	0.19	0.76	0.38	1.59	97.00	65.53

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Table 5.2 CIPW norm of 65 basalt analyses for the Nam Cho and the Sop Prab-Ko Kha basalts.

NORMATIVE SAMPLE	Q	Z	Or	Ab	An	Ne	Di	Wo	Hy	Ol	Mt	Cm	Hm	I1	Ap	Total
S - 2	4.79	0.04	8.06	24.37	28.23	-	4.90	-	12.65	-	4.68	0.03	2.67	3.67	1.67	95.76
S - 4	6.27	0.05	11.74	19.04	31.62	-	1.24	-	11.63	-	0.95	0.02	5.41	3.82	2.04	93.83
S - 8	3.12	0.05	16.05	23.61	28.07	-	3.14	-	9.06	-	4.60	0.02	1.75	4.03	2.05	95.54
S - 11	5.25	0.05	8.13	27.58	29.98	-	1.15	-	10.78	-	3.19	0.02	3.12	4.06	2.10	95.42
S -13	4.35	0.04	7.36	29.61	28.98	-	1.65	-	10.77	-	3.96	0.02	1.99	4.58	2.03	95.34
S 1-1	0.77	0.04	17.65	21.74	26.20	-	6.10	-	12.96	-	5.73	0.03	-	3.89	1.77	96.89
S 1 - 7	4.86	0.04	14.67	17.94	28.12	-	7.96	-	9.05	-	5.68	0.03	2.84	3.78	1.48	96.45
S 1 - 10	0.11	0.04	12.95	16.67	28.63	-	11.00	-	15.50	-	5.55	0.03	-	3.82	1.53	95.83
S 1 - 13 - 2	-	0.04	10.83	20.31	27.77	-	8.22	-	9.93	8.08	4.38	0.03	-	3.91	1.67	95.61
S 1 -14	3.78	0.05	8.53	18.53	29.46	-	8.66	-	11.41	-	8.49	0.03	0.15	3.95	1.67	94.71
S 7-2	5.87	0.05	11.32	21.07	31.30	-	2.29	-	9.70	-	6.08	0.02	0.59	4.01	1.98	94.28
S 7-3-1	5.59	0.04	15.17	14.30	30.24	-	7.26	-	8.96	-	4.21	0.03	2.87	3.89	1.70	94.25
S 7-5	0.66	0.02	12.46	13.37	29.92	-	11.43	-	15.94	-	5.09	0.03	-	3.68	1.45	94.06
S 8-2	4.13	0.04	8.53	22.68	29.05	-	6.55	-	11.42	-	7.87	0.03	0.32	3.99	1.69	96.30
S 8-5	6.75	0.05	3.68	21.07	30.70	-	6.42	-	10.83	-	6.42	0.03	1.91	4.06	1.86	93.79
S 18-1	5.15	0.05	9.07	26.14	31.18	-	-	-	11.26	-	2.17	0.02	4.38	4.01	2.18	95.62
S 18-2	3.12	0.05	19.82	17.43	29.60	-	1.99	-	11.56	-	2.50	0.02	4.07	4.01	2.03	96.20
S 18-3	-	0.05	21.66	17.77	27.42	-	6.51	-	7.35	4.77	4.47	0.02	-	3.82	2.03	95.86
S 18-5-2	-	0.04	16.58	20.22	26.65	-	10.12	-	10.40	0.10	7.19	0.02	-	3.80	1.60	96.73
S 18-7	-	0.04	13.62	20.14	27.88	-	6.82	-	12.16	6.23	4.23	0.02	-	3.70	1.65	96.49
S 19-1	5.50	0.05	17.17	14.72	31.34	-	1.68	-	12.08	-	5.11	0.02	1.47	3.80	1.91	94.85
S 19-3	3.24	0.06	11.51	27.24	28.92	-	2.39	-	10.48	-	5.11	0.01	1.36	3.80	2.09	96.20
S 19-5	3.12	0.04	12.08	18.61	30.34	-	6.30	-	11.99	-	5.96	0.02	0.69	3.72	1.84	94.71
S 19-7	4.48	0.04	16.26	15.65	29.40	-	6.18	-	11.34	-	7.64	0.02	0.28	3.68	1.60	96.57

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Table 5.2 (cont.)

NORMATIVE SAMPLE	Q	Z	Or	Ab	An	Ne	Di	Wo	Hy	Ol	Mt	Cm	Hm	I1	Ap	Total
S 19-9	-	0.04	16.75	14.55	27.88	-	8.45	-	14.64	3.95	4.15	0.02	-	3.67	1.50	95.59
S 21-1	5.16	0.05	9.01	24.96	31.37	-	0.26	-	13.41	-	4.83	0.02	-	3.93	2.15	95.15
S 21-4-2	7.73	0.05	8.17	21.66	31.07	-	3.02	-	10.79	-	1.64	0.03	5.90	3.89	1.92	95.86
S 21-6	0.06	0.04	12.31	18.78	28.65	-	7.06	-	17.61	-	5.67	0.02	-	3.74	1.57	95.51
S 21-8	0.65	0.04	14.73	14.13	28.73	-	7.11	-	19.73	-	5.06	0.02	-	3.74	1.57	95.53
S 21-10	-	0.04	14.14	15.14	28.56	-	14.88	-	9.77	4.11	3.33	0.02	-	3.72	1.50	95.23
S 24-1	5.30	0.06	10.73	20.64	31.80	-	1.01	-	13.52	-	5.76	0.02	-	3.78	2.20	94.64
S 24-2	5.20	0.05	9.25	26.82	30.29	-	1.46	-	9.91	-	3.06	0.02	3.77	3.93	2.06	95.82
S 24-4	-	0.05	16.27	18.36	27.94	-	7.81	-	11.40	4.70	3.96	0.03	-	3.82	1.74	96.07
S 24-6	-	0.04	15.03	17.51	26.70	-	9.51	-	12.44	5.05	4.05	0.02	-	3.65	1.50	95.49
S 24-7	-	0.04	14.78	17.34	27.62	-	9.05	-	13.70	4.66	4.06	0.03	-	3.67	1.50	96.45
S 29-1	2.62	0.05	8.95	30.12	28.38	-	2.81	-	10.88	-	3.64	0.02	3.00	3.89	2.01	96.37
S 29-3	3.92	0.04	7.86	28.94	27.85	-	6.70	-	8.69	-	0.03	0.03	7.65	3.76	1.72	97.18
S 29-5	5.81	0.05	17.16	13.88	31.13	-	3.04	-	11.42	-	1.99	0.02	5.11	3.85	1.87	95.33
S 29-10	-	0.04	13.01	19.97	27.61	-	7.41	-	13.10	4.94	3.76	0.02	-	3.84	1.57	95.28
S 29-11	-	0.04	15.86	22.42	25.43	-	11.19	-	0.98	12.74	3.84	0.03	-	3.74	1.67	97.94
S 2-2	2.85	0.05	7.64	22.76	28.64	-	7.15	-	11.44	-	7.78	0.04	0.55	4.10	1.89	94.89
S 13-1	-	0.05	18.28	15.70	27.17	2.68	19.34	-	-	1.76	4.06	0.03	-	3.99	1.82	94.87
S 6-2	-	0.04	15.92	13.79	27.90	-	10.46	-	12.86	0.95	3.38	0.03	4.46	3.89	1.57	95.25
S 14-7	-	0.04	16.16	14.21	27.53	-	9.14	-	15.31	1.20	6.05	0.03	-	3.84	1.50	95.00
S 12-6	-	0.04	17.69	14.94	24.61	3.00	12.07	-	-	14.98	3.23	0.03	-	4.05	1.55	96.19
S 20-2	1.15	0.05	8.48	29.95	27.32	-	3.86	-	13.12	-	5.67	0.02	-	4.01	1.96	95.59
S 14-1	4.30	0.05	16.99	12.44	31.10	-	4.37	-	11.44	-	3.97	0.02	2.29	3.78	1.91	92.66
S 22-4-1	-	0.04	17.04	14.05	14.69	13.20	18.91	-	-	8.93	5.18	0.03	-	3.78	1.55	97.39

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Table 5.2 (cont.)

NORMATIVE SAMPLE	Q	Z	Or	Ab	An	Ne	Di	Wo	Hy	Ol	Mt	Cm	Hm	I1	Ap	Total
S 25-4	-	0.04	14.62	20.73	25.25	-	9.83	-	5.36	10.22	3.94	0.03	-	3.78	1.40	95.22
S 23-4-1	-	0.04	14.85	15.48	29.34	-	11.41	-	12.64	4.09	3.16	0.03	-	3.93	1.50	96.48
S 28-1	2.54	0.05	9.20	30.71	27.90	-	2.70	-	9.78	-	3.32	0.02	2.87	3.97	2.18	95.25
S 28-2	0.65	0.05	19.11	22.59	25.91	-	6.59	-	9.26	-	3.06	0.02	4.12	3.99	1.81	97.17
S 28-3	-	0.04	16.03	8.99	23.21	7.73	26.15	1.82	-	-	4.45	0.02	-	3.78	1.50	93.73
S 28-4	-	0.04	14.10	20.98	26.14	-	9.22	-	7.35	7.88	4.31	0.03	-	3.76	1.52	95.32
S 27-11	-	0.04	17.45	14.21	27.79	-	10.05	-	2.56	14.41	3.35	0.03	-	4.20	1.62	95.71
N -1	-	0.04	5.73	20.15	24.46	4.30	15.33	-	-	12.37	6.86	0.02	-	4.71	1.79	95.77
N -2	-	0.05	15.20	13.58	23.22	5.48	14.33	-	-	10.58	7.65	0.02	-	4.50	1.91	96.53
N -3	-	0.05	15.28	12.22	23.72	5.44	14.49	-	-	10.20	7.99	0.02	-	4.69	1.89	95.98
N -4	-	0.04	5.82	19.38	26.03	2.52	14.54	-	-	14.21	6.31	0.03	-	4.80	1.57	95.26
N - 5	-	0.05	16.11	18.36	20.39	5.64	12.98	-	-	8.80	8.13	0.03	-	3.95	1.79	96.23
N -7	-	0.05	18.19	12.99	19.65	8.55	16.11	-	-	5.55	10.38	0.02	-	4.41	1.96	97.85
N -8	-	0.05	17.04	17.70	21.11	4.89	13.36	-	-	8.62	8.97	0.03	-	4.03	1.91	97.75
N -9	-	0.05	16.34	15.20	19.94	6.62	15.13	-	-	8.98	8.77	0.03	-	4.16	1.81	97.03
N -11	-	0.05	17.23	16.16	20.60	5.50	13.80	-	-	9.84	8.09	0.04	-	4.01	1.77	97.10
N -12	-	0.04	16.92	15.01	21.07	7.18	13.65	-	-	11.43	6.26	0.03	-	3.95	1.81	97.36

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SiO_2: The average content of SiO_2 of the Nam Cho basalt is about 44.16 % relatively less than that of the Sop Prab-Ko Kha basalt (47.8%). The SiO_2 content of the Sop Prab-Ko Kha basalt shows a progressive increase from the lower to the upper flows, as indicated by the average values of 47.19 % of the first flow, 47.48 % of the second flow, 47.09 % of the third flow, 48.50 % of the fourth flow, and 48.73 % of the fifth flow.

Al_2O_3 : The Nam Cho basalt contains av. Al_2O_3 (15.82 %) relatively lower than those of flows of the Sop Prab-Ko Kha basalt (16.86%). In the Sop Prab - Ko Kha basalt the Al_2O_3 content increases orderly from the lower to the upper flows, as shown by the values of 16.34 %, 16.73 %, 16.55 %, 17.26 %, 17.42 %, respectively.

Fe_2O_3 and FeO: It is evident that the Fe_2O_3 and FeO contents of the Nam Cho basalt, comprising approximately 5.48 % of Fe_2O_3 and 5.43 % of FeO, are relatively higher than those (4.41% and 4.28%, respectively) of the Sop Prab-Ko Kha basalt. However, these two iron oxides do not show any progressive change in their values in accordance with successive sequence of basaltic flow in the Sop Prab - Ko Kha area.

CaO: Ranges of CaO contents are frequently from 7.5 % to 9.5 %, from those of both basaltic areas. The Nam Cho basalt gives a mean CaO content of 8.98 %, while those of the Sop Prab-Ko Kha basalt tends to decrease gradually from the lowest to the uppermost flows, as indicated by 8.75 %, 8.31 %, 8.93 %, 8.19 %, 7.64 %, respectively.

MgO: Average MgO content of the Nam Cho basalt is relatively higher than those of the Sop Prab-Ko Kha basalt. The latter decreases distinctively from the lower to the upper flows, and exception arises for the fourth flow.

Na_2O: The Nam Cho basalt contains 3.12 % of mean Na_2O higher than those of the Sop Prab-Ko Kha basalt, and slightly increase respectively from the lower to the upper flows, i.e., 2.21%, 2.25 %, 2.06 %, 2.46 %, and 2.87 %.

K_2O: K_2O contents of the Sop Prab-Ko Kha basalt do not exhibit a clear trend, however, they seem to increase apparently from the first to the third flow, and then decreasing from the third to the fifth flow as shown by their contents of 2.22%, 2.27 %, 2.61 %, 2.34 %, and 1.8 %. The Nam Cho basalt contains about 2.43 % of mean K_2O content.

TiO_2: The TiO_2 contents of the Nam Cho basalt give an average amount to 2.28 %. They are higher than those of the Sop Prab-Ko Kha basalt. Their means are nearly the same amount from the first to the last flow which are 2.05 %, 2.01 %, 2.00 %, 2.04 %, and 2.06 %, respectively.

MnO: The ranges of MnO contents of each flow of the Sop Prab-Ko Kha basalt are relatively restricted. Their mean range from 0.13 to 0.16 %, while that of the Nam Cho basalt is slightly higher, i.e. 0.2 %.

P_2O_5: The P_2O_5 contents of both basaltic areas do not exhibit a clear trend and seem to be restricted from 0.7 to 0.8 %. The Nam Cho basalt comprises 0.76% of mean P_2O_5 content, whereas the Sop Prab-Ko Kha basalt contains orderly from the bottom to the top flows as 0.69 %, 0.68 %, 0.72 %, 0.78 %, and 0.82% of each mean.

Table 5.3 Averages of the major element analyses of each basaltic flow from the Nam Cho and the Sop Prab-Ko Kha basalts.

Basaltic Area	Basaltic Flow	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	K_2O	TiO_2	MnO	P_2O_5	H_2O	LOI	Total
Nam Cho Basalt		44.16	15.82	5.48	5.43	8.98	7.24	3.12	2.43	2.28	0.20	0.76	0.66	2.02	98.58
Sop Prab-Ko Kha Basalt	The fifth flow	48.73	17.42	4.85	3.65	7.64	5.04	2.87	1.80	2.06	0.14	0.82	0.99	3.17	99.18
	The fourth flow	48.50	17.26	5.64	2.68	8.19	4.85	2.46	2.34	2.04	0.13	0.78	0.77	3.39	99.03
	The third flow	47.09	16.55	4.24	4.29	8.93	6.14	2.06	2.61	2.00	0.15	0.72	0.69	3.65	99.12
	The second flow	47.48	16.73	3.96	5.05	8.31	6.46	2.25	2.27	2.01	0.14	0.68	0.68	3.04	99.06
	The first flow	47.19	16.34	3.36	5.74	8.75	6.69	2.21	2.22	2.05	0.16	0.69	0.67	3.01	99.08

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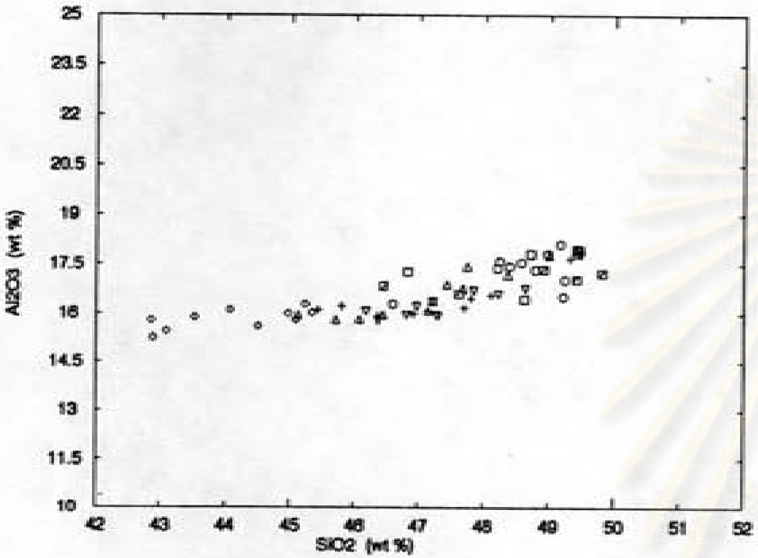
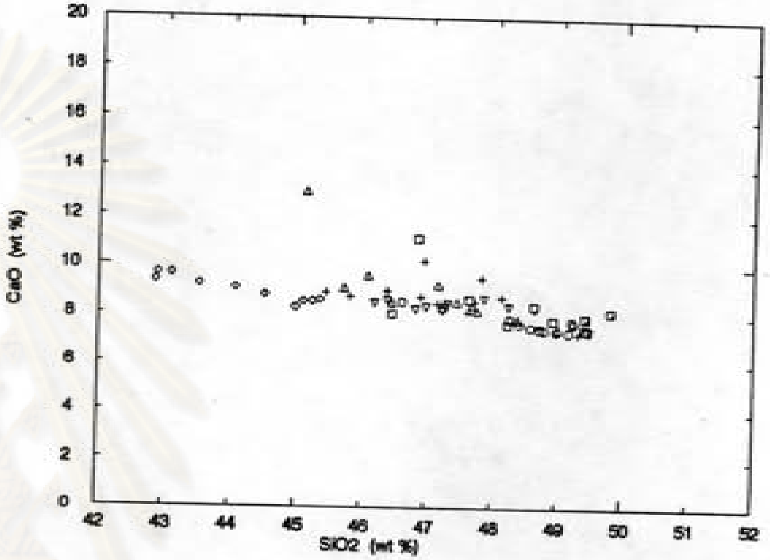
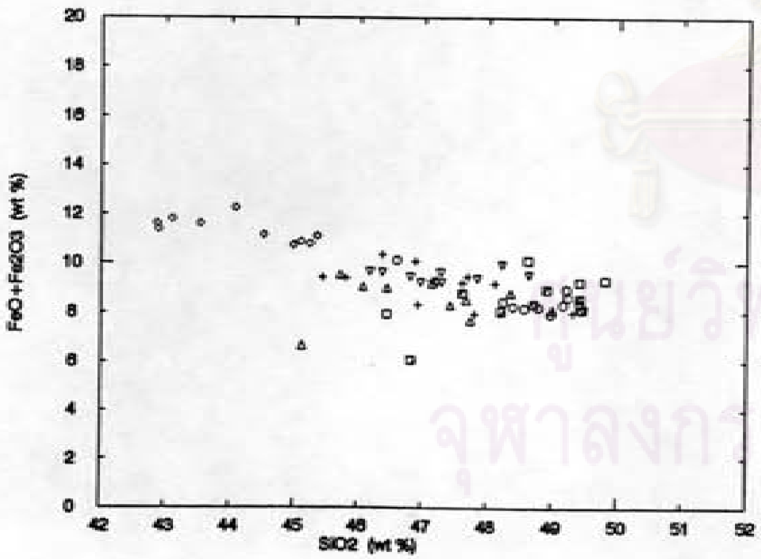
One of the oldest and most commonly used types of variation diagram in igneous petrology is the Harker diagram (Harker, 1909), in which the weight percent of a concerned oxide is plotted against wt% of SiO_2 (Fig. 5.1). Several Harker diagrams show positive correlation with SiO_2; including Al_2O_3, Na_2O, Fe_2O_3 , whereas some show negative correlation- CaO, Fe_2O_3(t), FeO, TiO_2 and MgO, and few depict no correlation with SiO_2, including, K_2O, P_2O_5 and MnO. However, when a comparison is made for those of the Nam Cho and the Sop Prab-Ko Kha data, it is quite possible that some values (as FeO, and K_2O) of these two basalts do not follow the same trend. In fact a few show subparallel liquid lines of descent (as Al_2O_3, MgO, and MnO), suggesting the difference in the petrochemical evolution.

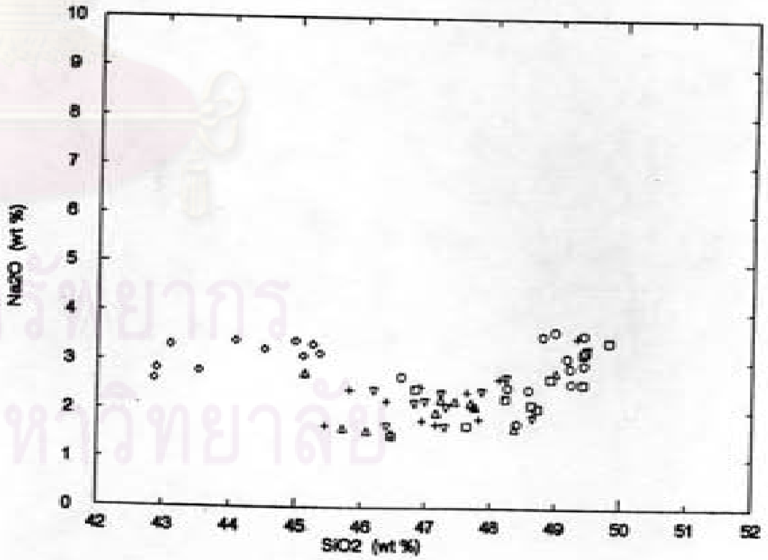
The most commonly used alternative to the Harker diagram is the MgO bivalent plot which is suggested for rocks containing highly variable contents of MgO values (Rollinson, 1993). The plots of MgO versus other -oxide values are used herein because there exists an overlap range of Mg values for basalts from two areas. These are shown in Fig. 5.2. In general, the plots depict the results opposite to those of the SiO_2, since SiO_2 and MgO plots depict strongly negative correlation. In this study, the results gathered from these bivalent plots give the evolutionary trend similar to those of the SiO_2. Similar results can be made for the plots of solidification index [100MgO / ($MgO+FeO+Fe_2O_3+Na_2O+K_2O$)] versus oxides, as illustrated in Fig. 5.3. Therefore, it is quite important to note that several different variation diagrams of bivalent plots indicate that the Nam Cho basalt and the Sop Prab-Ko Kha basalt have not been evolved from the cogenetic magmatic sources. Classification of basalts using geochemical data variation diagrams with TiO_2 and MnO content (Fig. 5.1) display strongly inflected and segmented trends, respectively, especially for the Sop Prab-Ko Kha basalt possibly providing powerful evidence for the different operation in crystal - liquid seperation during magmatic evolution. In general, inflections in trends are interpreted to mark the onset of crystallization

Fig.5.1. Harker variation diagrams of major oxides versus SiO_2 for basalts in the study area.









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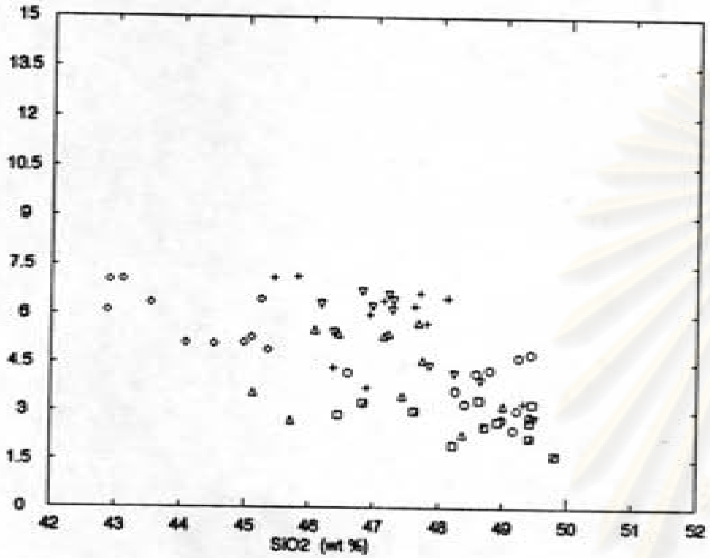

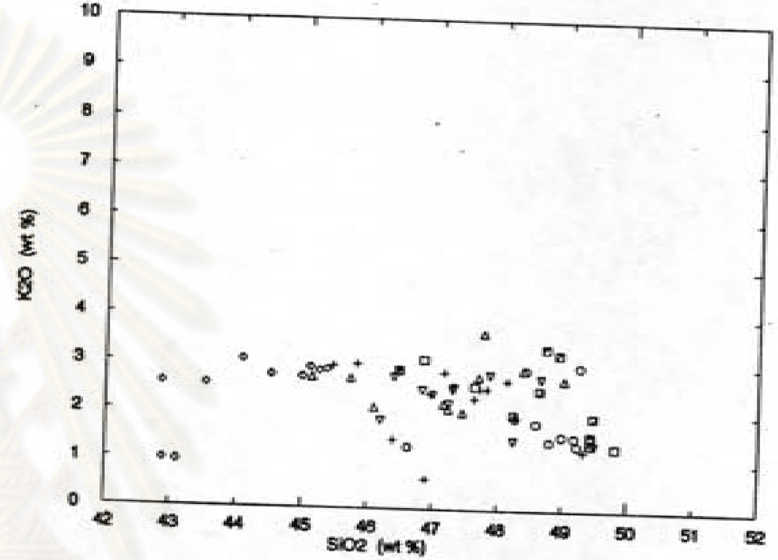

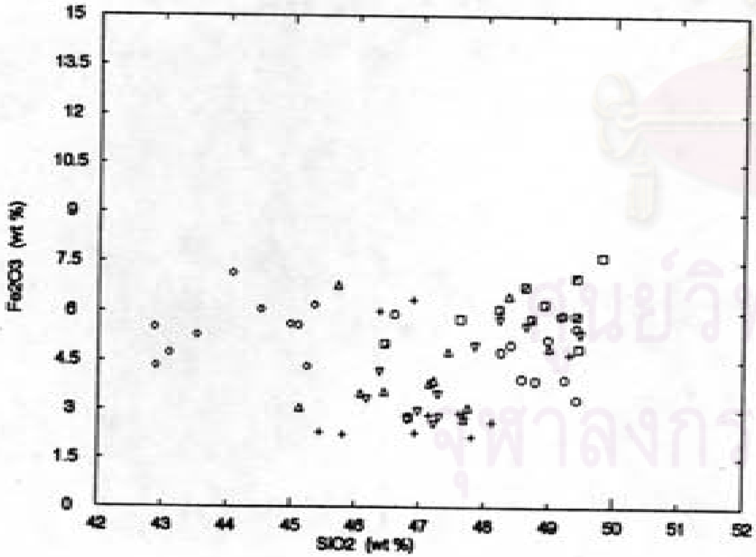

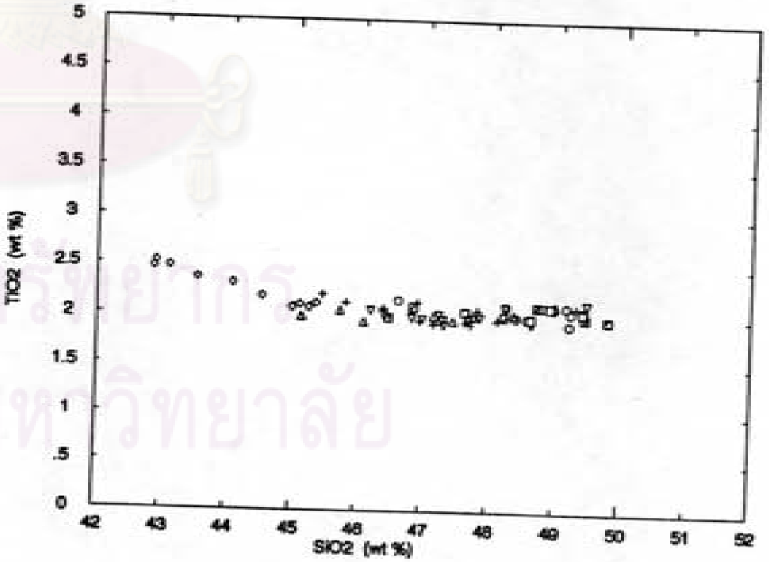

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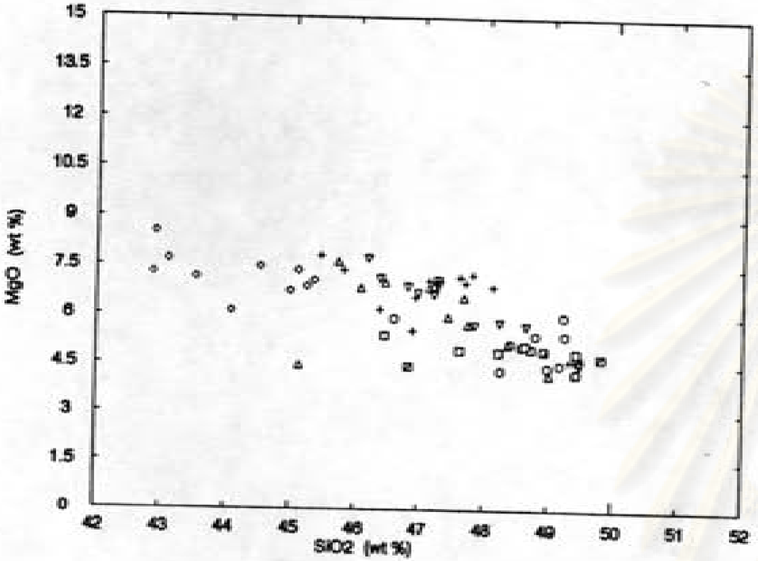

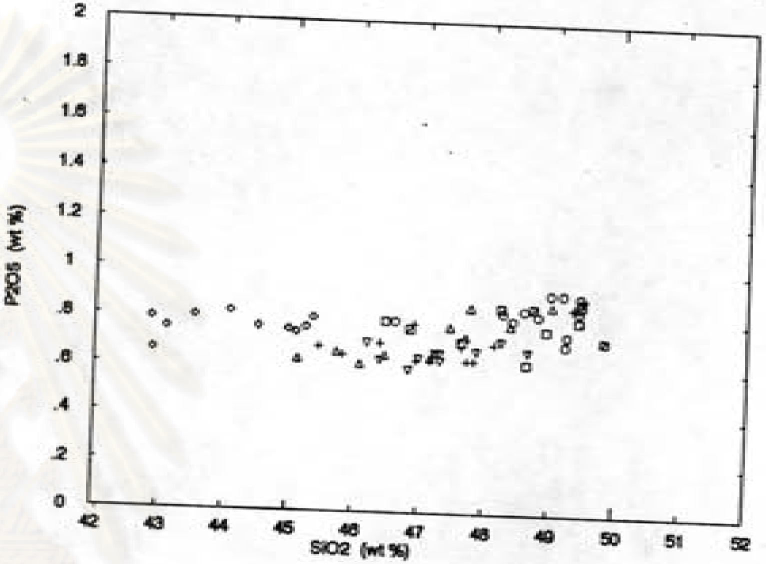

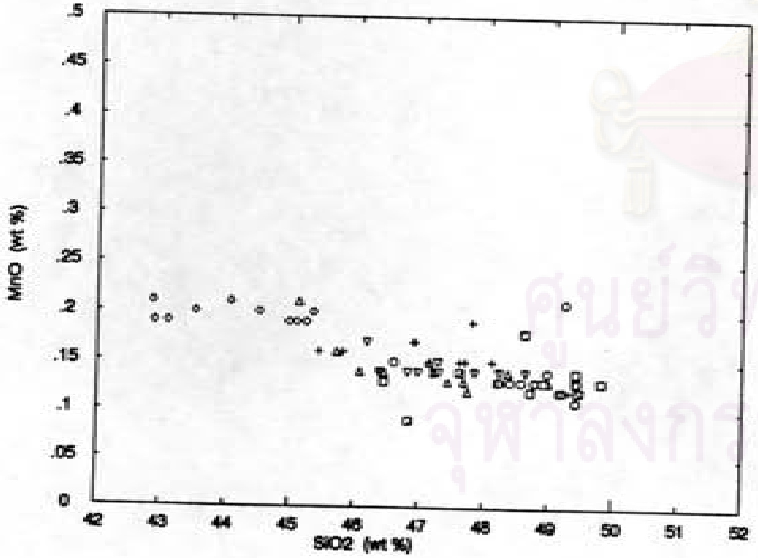

SYMBOL

◇ The Nam Cho Basaltic Suites
○ The Fifth Flow of Sop Prab - Ko Kha Basalt
▩ The Fourth Flow of Sop Prab - Ko Kha Basalt
△ The Third Flow of Sop Prab - Ko Kha Basalt
▽ The Second Flow of Sop Prab - Ko Kha Basalt
\+ The First Flow of Sop Prab - Ko Kha Basalt

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Fig.5.2. Variation diagrams plotting of MgO versus the other major oxides for the Nam Cho and the Sop Prab-Ko Kha basalts.

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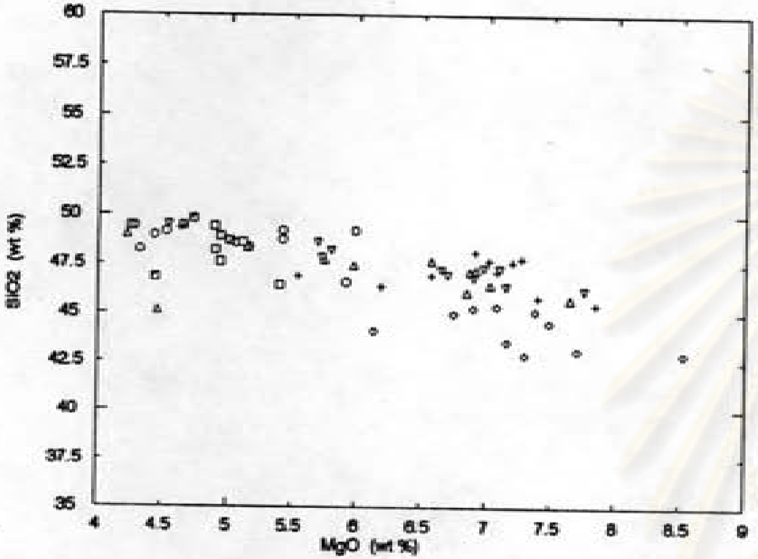

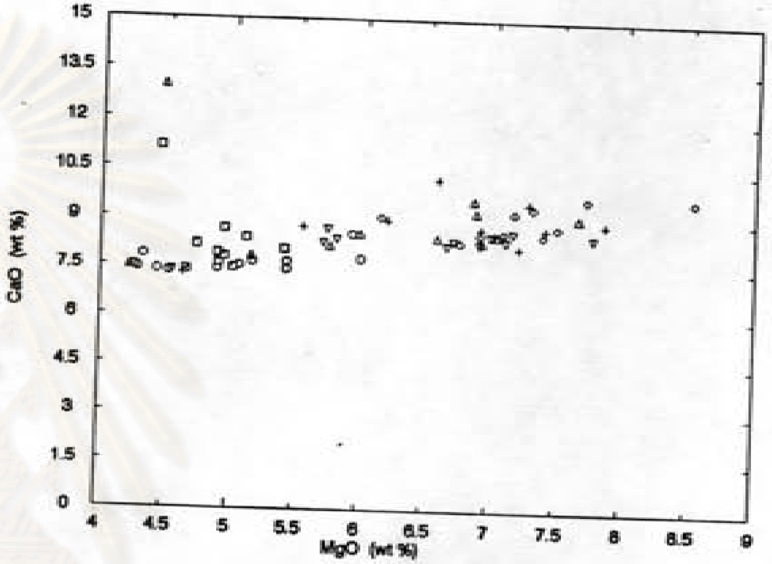

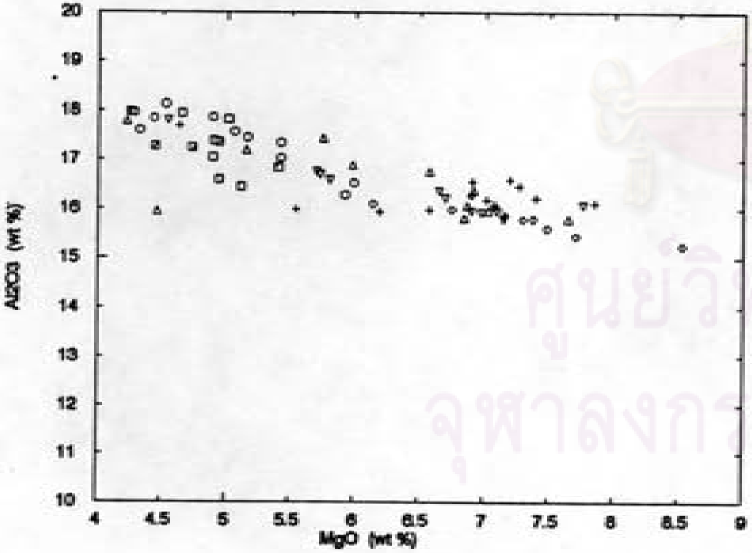

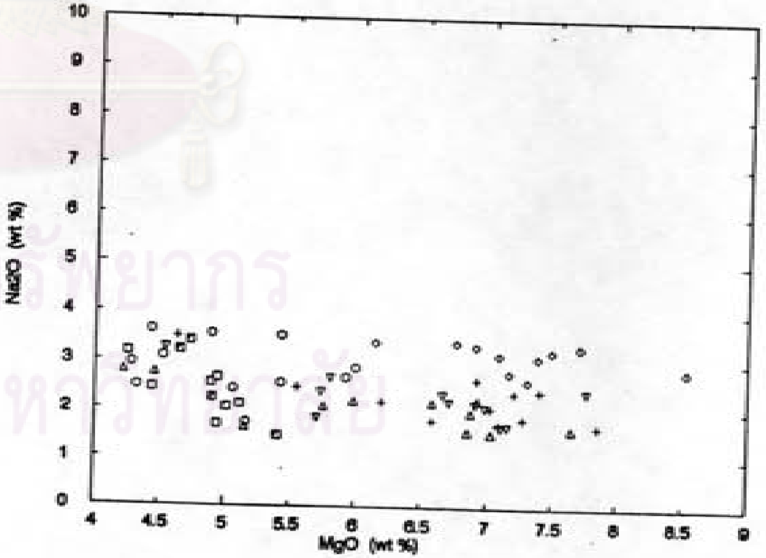

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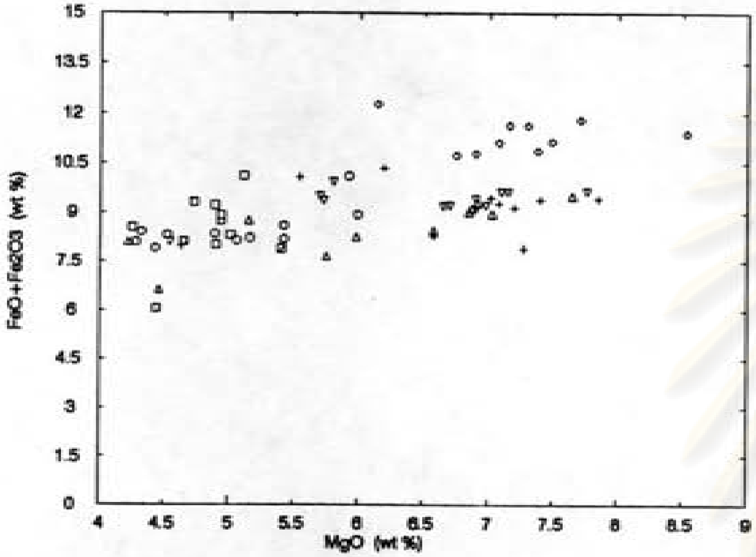

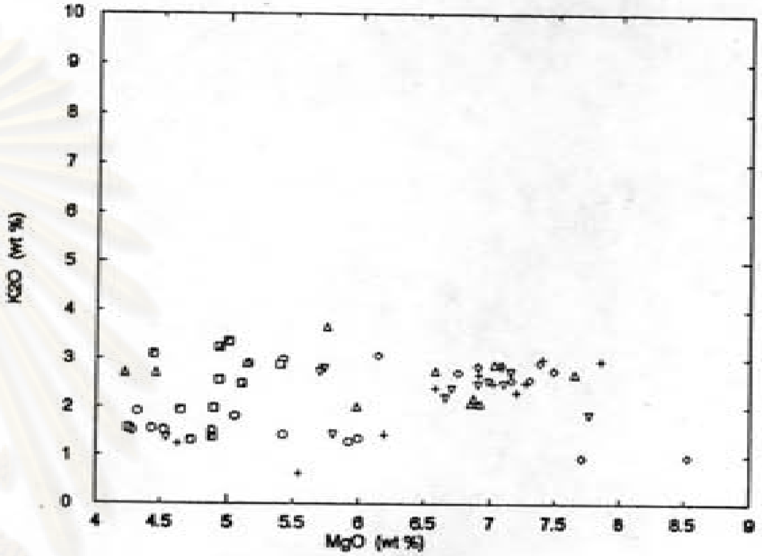

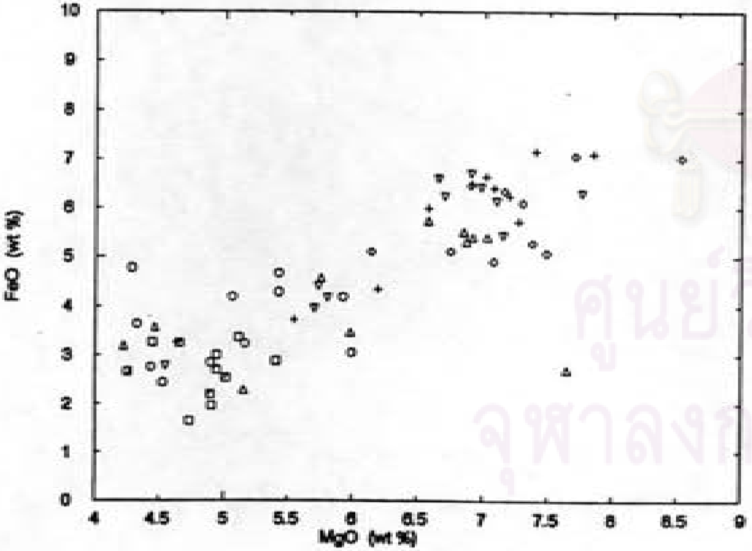

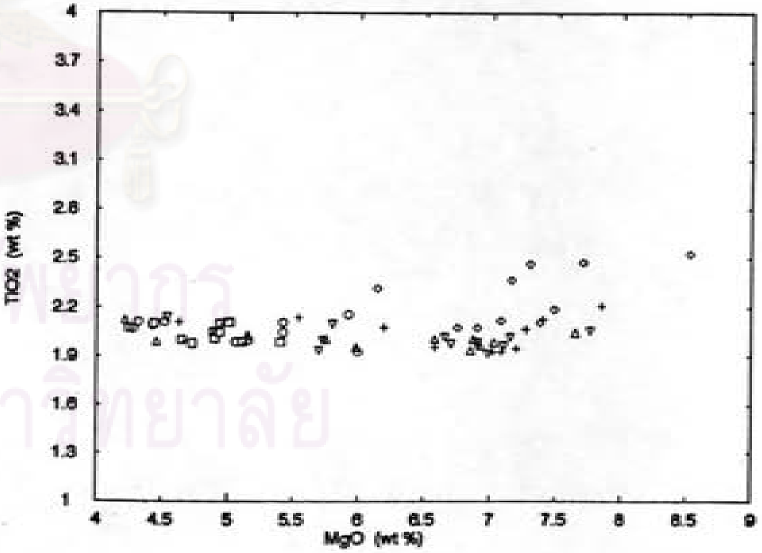

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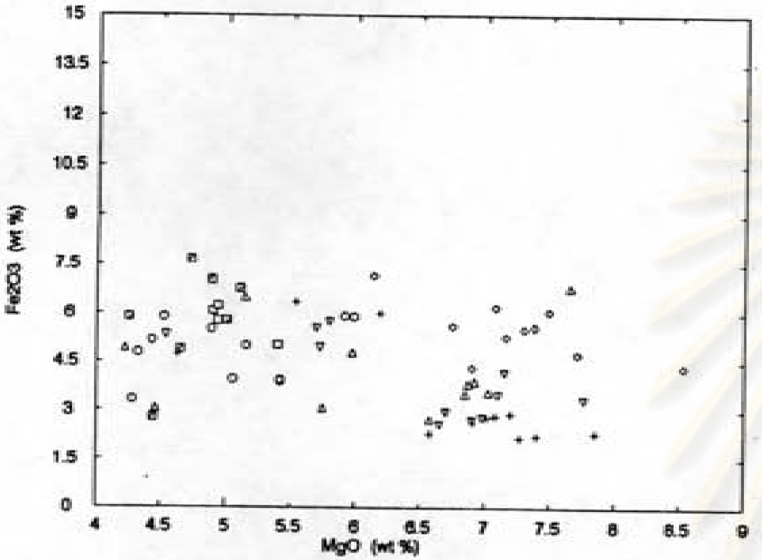

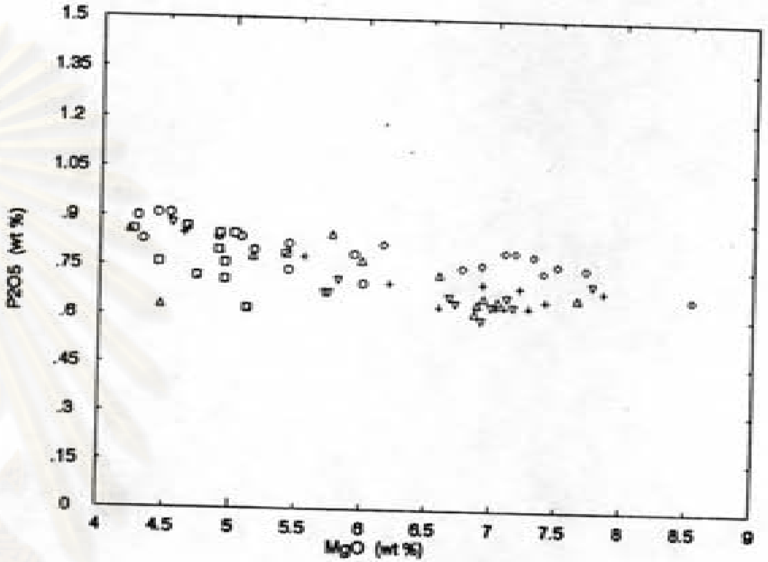

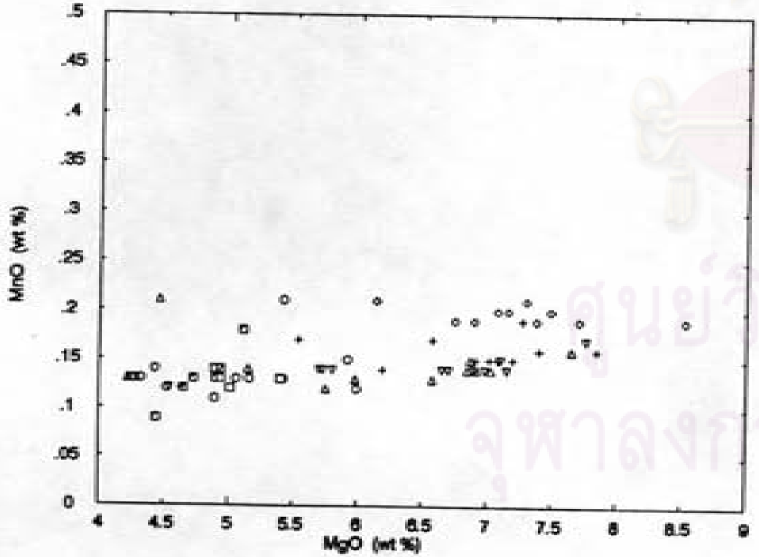

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Fig.5.3. Variation diagrams plotting of Solidification Index (S. I.) against major oxides for the Nam Cho and the Sop Prab-Ko Kha basalts.

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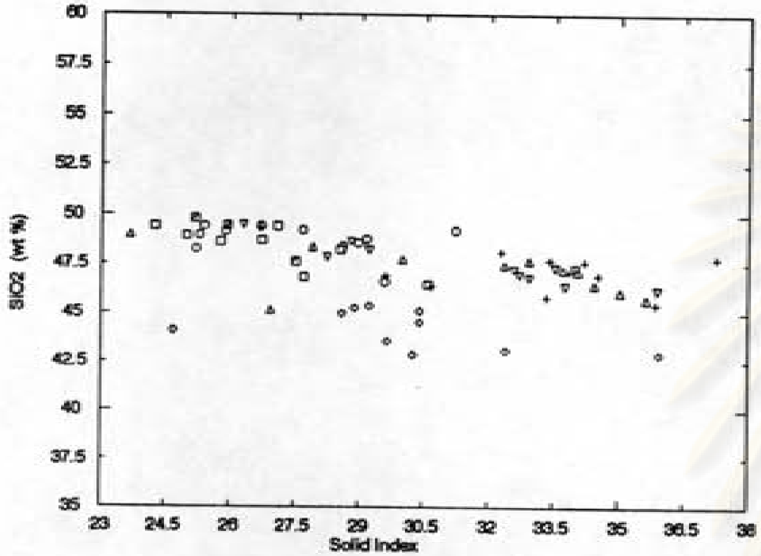

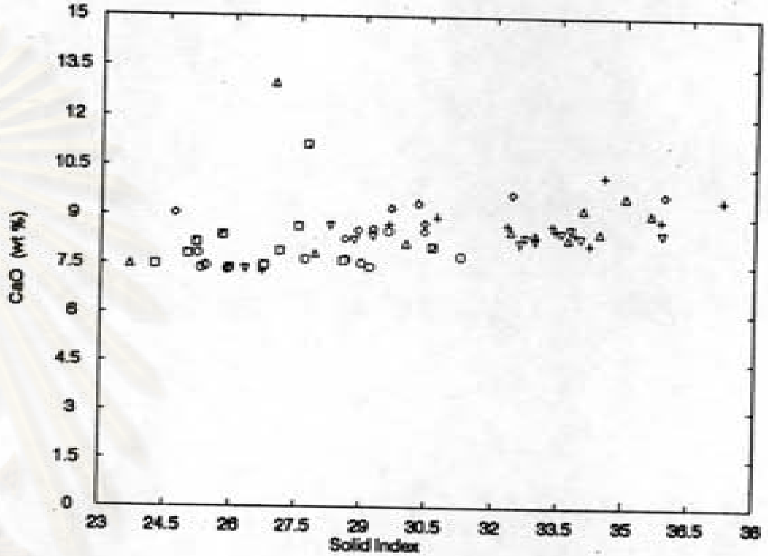

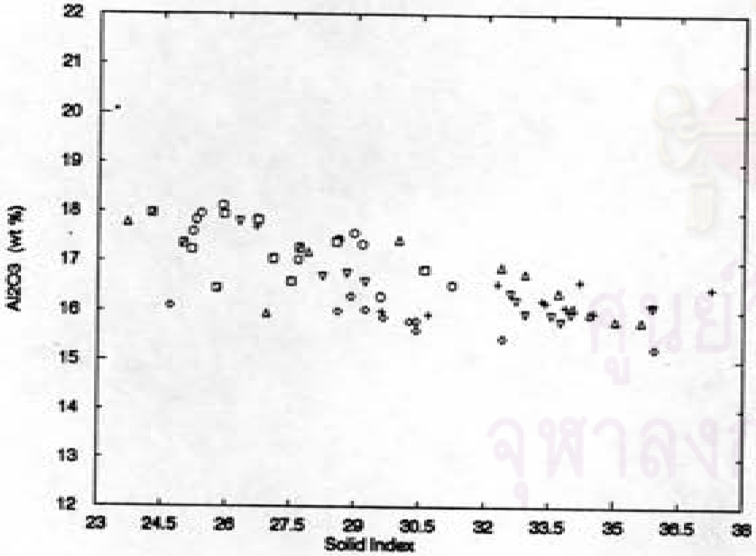

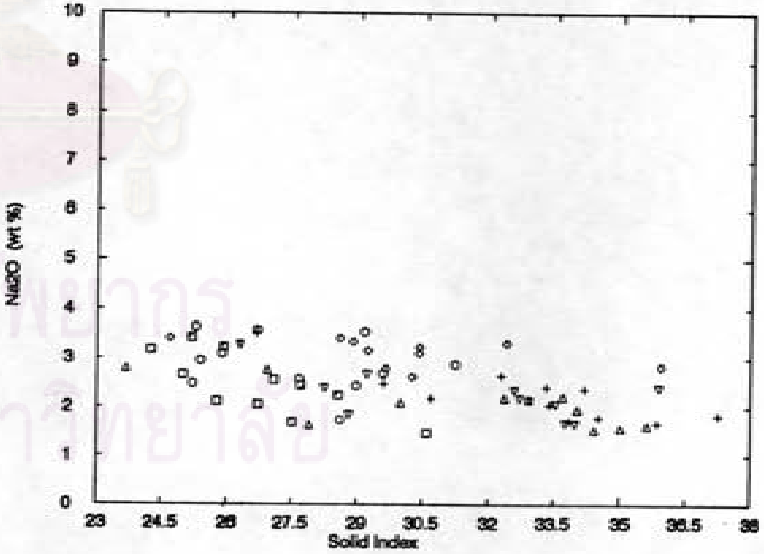

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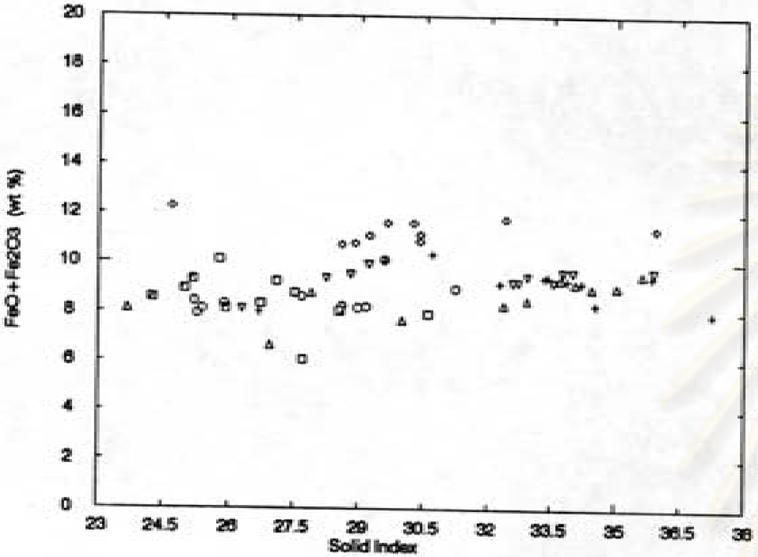

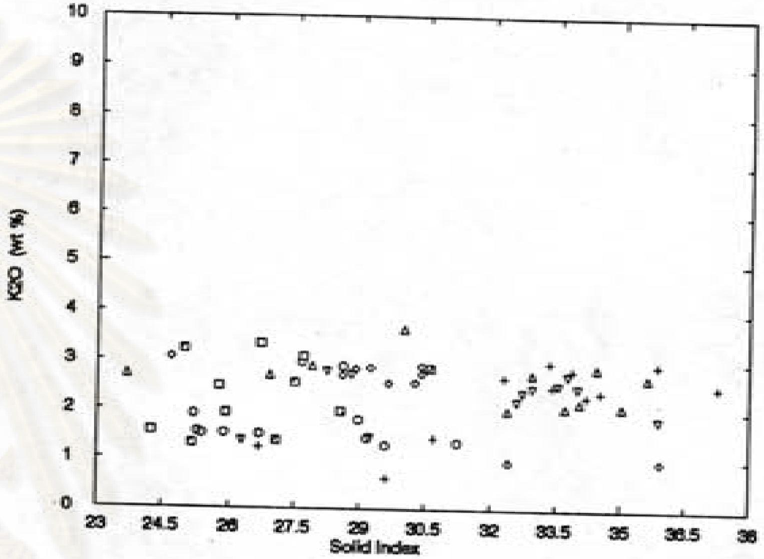

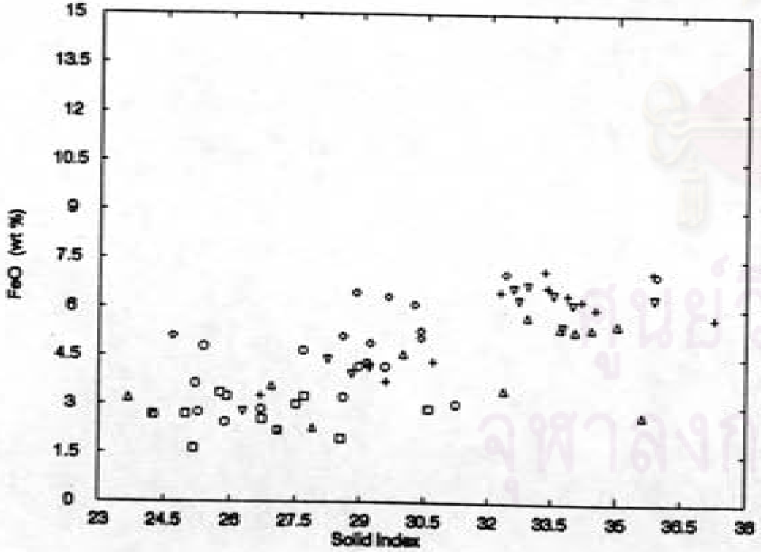

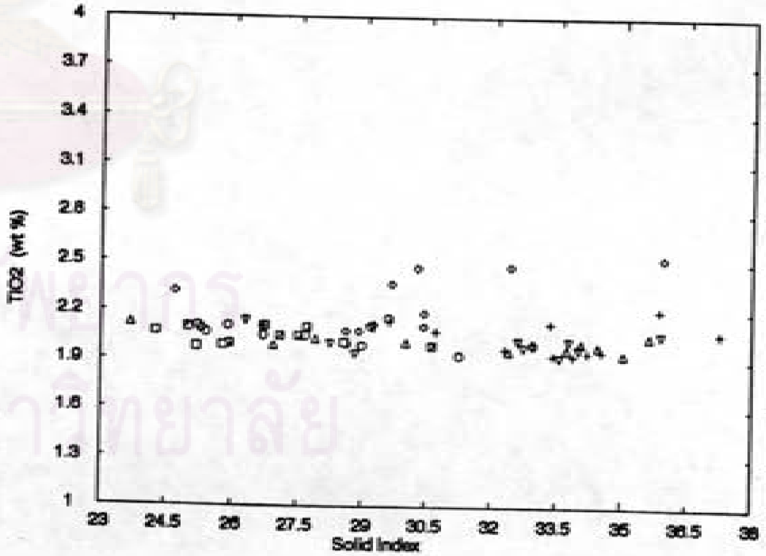

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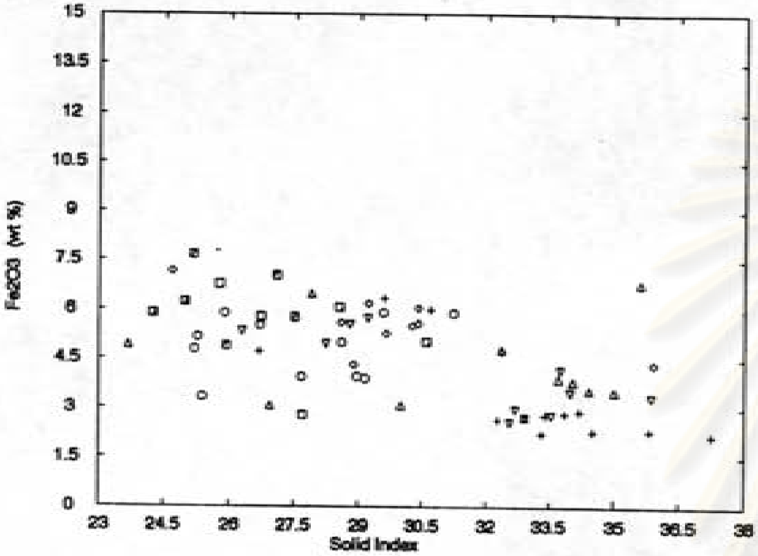

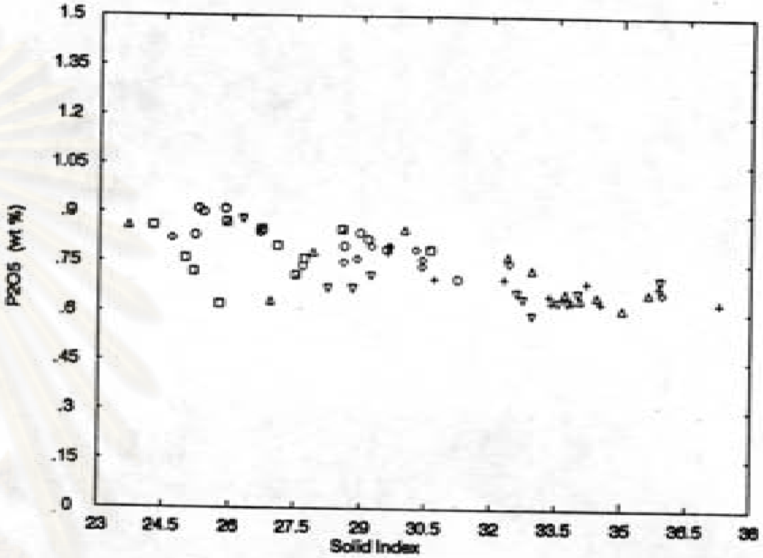

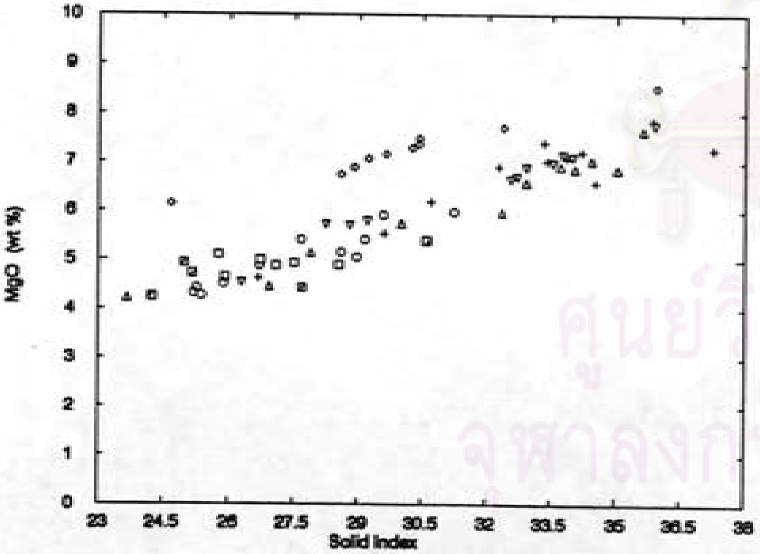

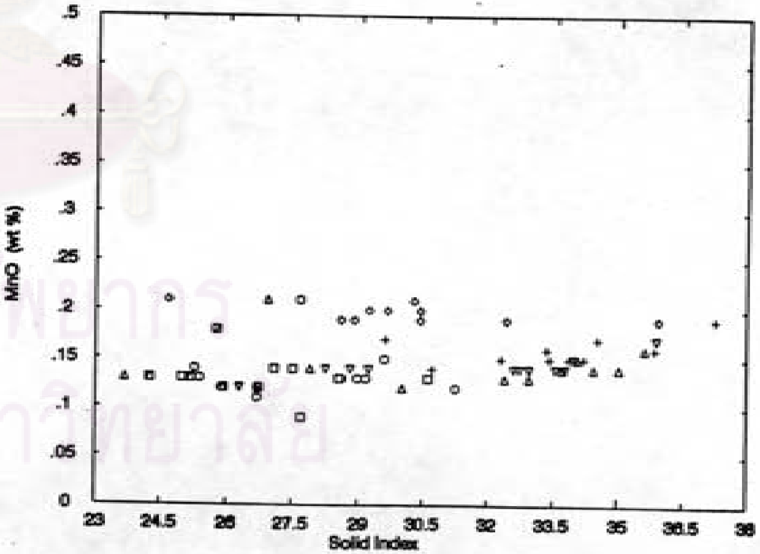

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of new mineral species. It is important to point out that the variation of Al_2O_3, CaO, Fe_2O_3(total), Na_2O, TiO_2, and MnO versus SiO_2 for the Sop Prab-Ko Kha basalt show strongly segmented trends at 47-48 % SiO_2. Segmented linear correlation indicates the importance of different fractionation mineral assemblage in the magmatic evolution with points of inflection marking a new major crystallization phase. This can be interpreted herein in terms of crystal fractionation dominant by olivine and plagioclase whereas clinopyroxene does not appear as an dominant phase. These evidences seem fit fairly well with petrographic evidences. The total alkalis-silica (TAS) diagrams, one of the most useful classification schemes available for volcanic rocks (Cox et al., 1979), indicate that most of the values for the Sop Prab - Ko Kha volcanic are located in the basalt field, whereas those of the Nam Cho basalt are plotted somewhere along the line between the basanite + tephrite field and the basalt and hawaiite fields (Fig. 5.4). Discrimination of rock series can also be done using TAS. In this case volcanic rocks may be subdivided into two major magma series - the alkaline and the subalkaline (originally termed tholeiite) series (Irvine and Baragar, 1971). It is clear that both basalt series are almost totally plotted on the alkaline side (Fig. 5.5) close to the subalkaline - alkaline boundary. The same TAS plotting (after Middlemost, 1985) shows that the Nam Cho basalt clusters nicely in mainly the basanite, while the Sop Prab - Ko Kha basalt is concentrated in the alkaline olivine basalt (Fig. 5.6).

Total alkali ($CaO+K_2O+Na_2O$) versus SiO_2 (Fig. 5.7, Peacock, 1931) plots indicate the alkalic series for the Nam Cho and the Sop Prab - Ko Kha basalts. However, in term of a K_2O versus SiO_2 variation diagram (Fig. 5.1), both basalts span the range from subordinate subalkalic to predominant alkalic.

A plot of the Alkali Index [A.I. = $(Na_2O + K_2O) / 0.17 (SiO_2 - 43)$] versus % Al_2O_3 clearly establishes the field of the high Al basalt (Fig. 5.8). In addition, the

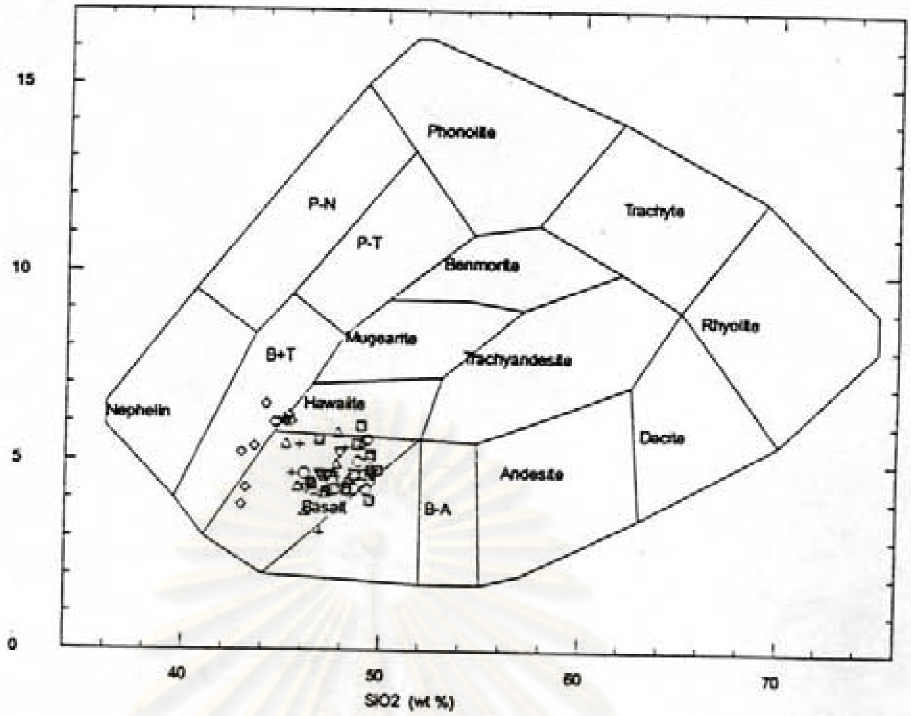

Fig.5.4. Plot of $Na_2O + K_2O$ against SiO_2 (fields from Cox et al., 1979).

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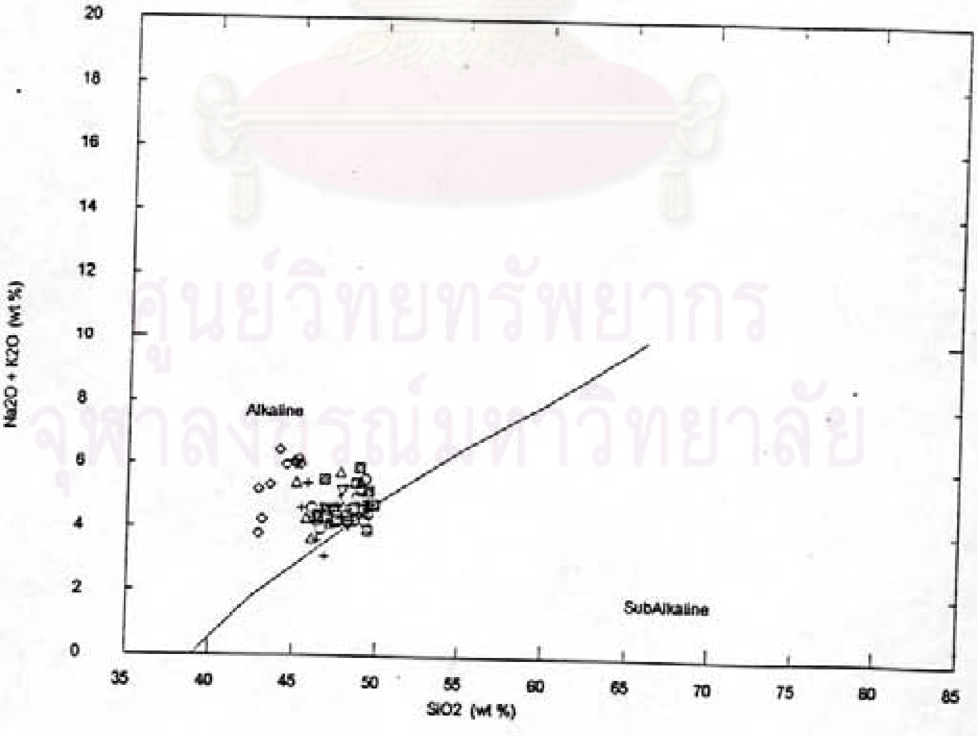

Fig.5.5. Total alkaline - SiO_2 plot (TAS) with line separating fields of alkaline and subalkaline magma series (Irvine and Baragar, 1971).

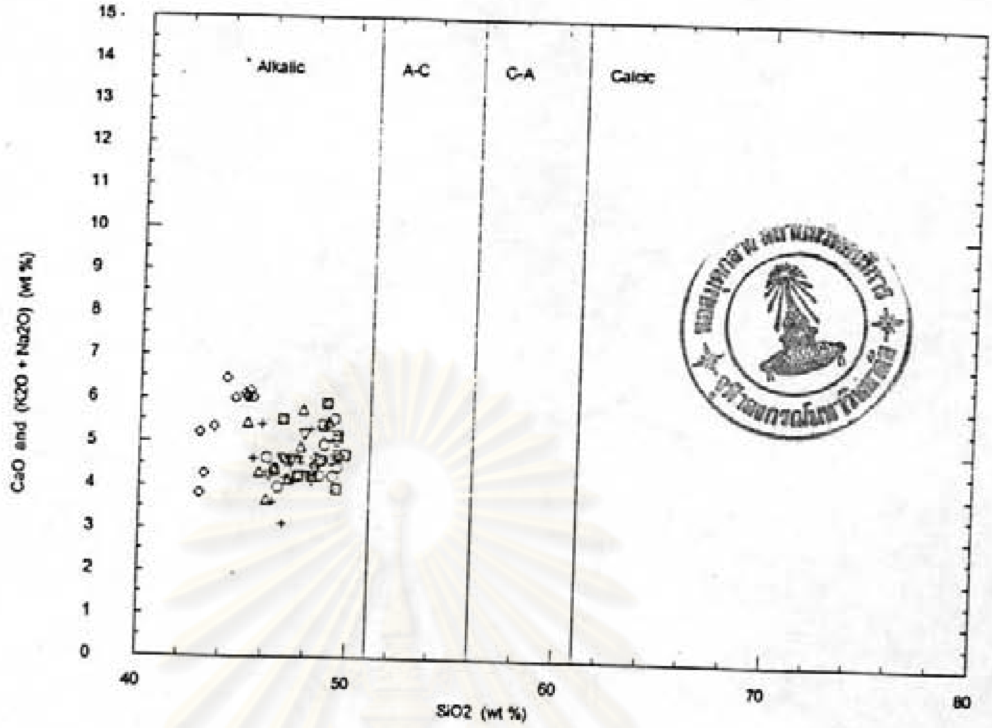

Fig.5.6. Chemical classification nomenclature using the total alkaline versus silica diagram (after Middlemost, 1985) shows basanite name of the Nam Cho basalt and alkaline olivine basalt of the Sop Prab-Ko Kha basalt.

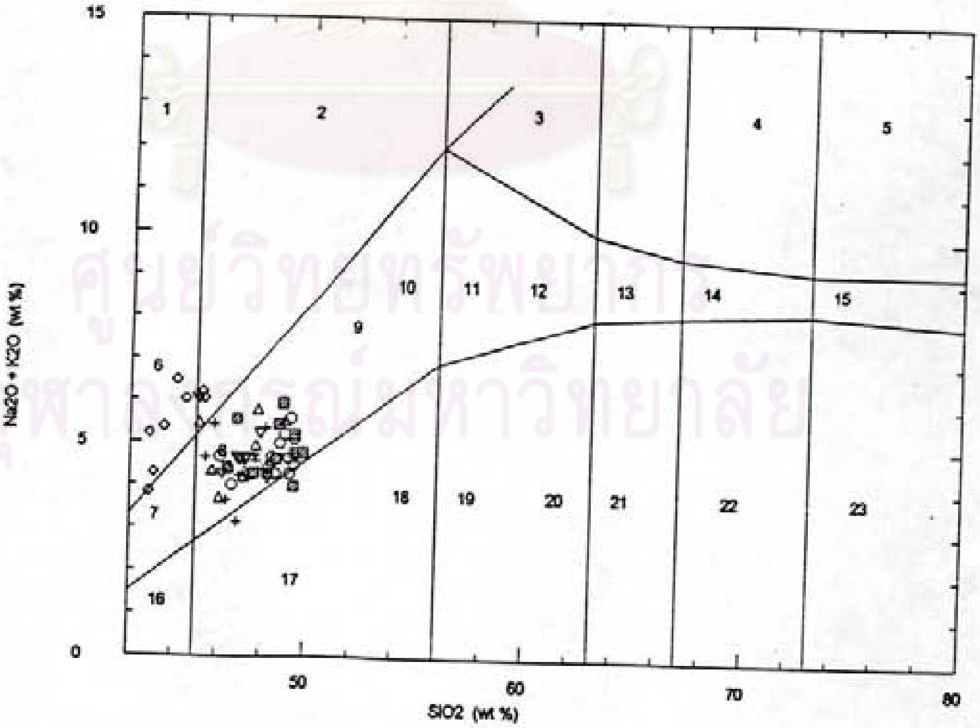

Fig.5.7. Plot of CaO and $K_2O + Na_2O$ versus SiO_2 (after Peacock, 1931) displays alkaline range of most sample plottings from the Nam Cho and the Sop Prab-Ko Kha basalts.

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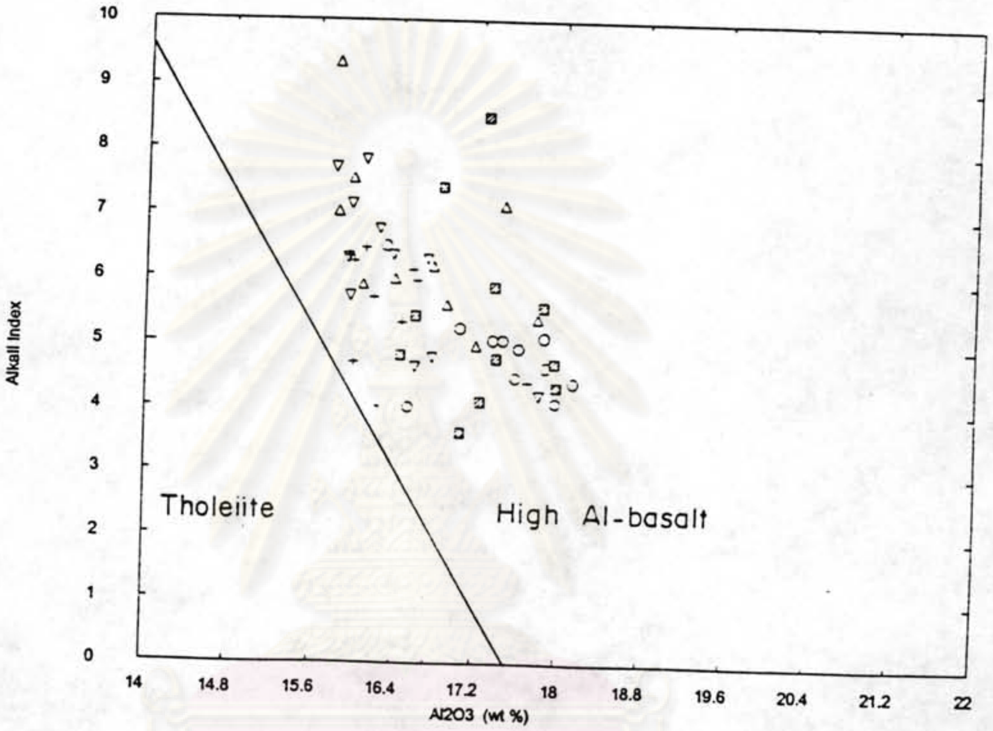

Fig.5.8. Plot of Alkali Index (A. I.) versus wt.% Al_2O_3 of the Nam Cho and the Sop Prab-Ko Kha basalts (fields from Middlemost, 1975).

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marked scatter in variation diagram, such as the K_2O - SiO_2 plot is interpreted to represent a natural consequence of polybaric crystal fractionation combined with source heterogeneity, variable degree of partial melting and crustal contamination (see also Cox, 1980). Quite more distinctive is the TiO_2 - SiO_2 and P_2O_5 - SiO_2 (or TiO_2-MgO and P_2O_5-MgO) plots which clearly differentiate between high TiO_2-P_2O_5 type for the Nam Cho basalt and low TiO_2-P_2O_5 type for the Sop Prab - Ko Kha basalt. Similar situation was made earlier for Parana basalts in Brazil (see also Mantovani et al., 1985, Petrini et al., 1987). Therefore, this is an ample evidence to conclude at present that those two basaltic rocks may have been evolved similar petrogenetic fashion but from different mantle source.

Trace Element Data

Table 5.4 illustrates the trace element values for the Nam Cho and the Sop Prab - Ko Kha basalts. The averages of these trace element of each basaltic flow from the both areas are present in Table 5.5. The detailed description of individual trace element is relatively given below.

Ba: Ba values of the Sop Prab - Ko Kha and the Nam Cho basalts range from 687 to 1057 ppm and average about 813.56 ppm.

Ce: Ranges of Ce contents are frequently from 29 to 46 ppm and average about 36.42 ppm, for basalt from both areas.

Co: The Nam Cho and the Sop Prab - Ko Kha basalts contain Co contents ranging from 50 to 71 ppm.

Table 5.4 Trace element analyses (in ppm) of 65 basalt samples for the Nam Cho and the Sop Prab-Ko Kha basalts.

SAMPLE	Ba	Ce	Co	Cr	Nb	Ni	Pb	Rb	Sr	V	Y	Zn	Zr
S-2	682	37	51	153	47	161	26	66	984	324	24	50	218
S-4	826	28	50	103	56	106	23	99	1902	347	22	51	260
S-8	878	47	42	91	61	107	35	82	1024	354	13	74	254
S-11	832	43	41	91	57	107	30	93	1303	370	10	68	266
S-13	838	46	65	89	58	99	29	90	986	345	24	43	219
S1-1	766	32	48	140	43	122	28	95	1327	350	82	43	187
S1-7	778	36	47	150	30	131	38	38	1243	351	31	80	198
S1-10	676	28	56	132	33	122	36	28	1862	343	17	69	197
S1-13-2	766	36	53	118	37	148	44	35	943	363	25	66	218
S1-14	903	44	48	149	41	140	23	40	1122	365	22	74	239
S7-2	804	27	46	86	50	95	40	73	1407	359	12	60	253
S7-3-1	681	25	39	156	38	113	10	95	2726	351	76	65	196
S7-5	617	22	44	130	39	114	11	114	1107	326	114	42	116
S8-2	698	30	48	151	42	117	46	37	910	371	28	76	202
S8-5	823	39	46	141	35	163	52	50	1113	369	21	71	243
S 18-2-1	966	48	50	84	61	75	5	79	1248	342	33	10	270
S 18-3	977	36	56	98	58	86	5	56	1072	337	41	67	249
S 18-5-2	905	36	54	83	52	90	5	79	1101	328	31	29	254
S 18-7	778	20	57	94	36	123	5	89	1639	338	37	17	221
S 18-11	731	20	59	104	40	97	5	72	848	335	21	63	218
S 19-1	782	28	60	78	58	95	5	76	1396	391	44	67	258
S 19-3	843	31	64	69	58	78	5	109	2171	390	26	52	275
S 19-5	695	24	47	100	44	87	48	373	2305	372	416	75	220
S 19-7	667	22	58	101	39	102	5	336	1352	382	513	28	178
S 19-9	666	41	52	115	33	100	5	52	852	371	32	61	187

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Table 5.4 (cont.)

SAMPLE	Ba	Ce	Co	Cr	Nb	Ni	Pb	Rb	Sr	V	Y	Zn	Zr
S 21-1	894	63	52	92	58	97	5	74	1193	358	21	57	245
S 21-4-2	773	34	59	132	49	90	5	45	1858	359	35	63	225
S 21-6	699	45	57	77	39	105	5	33	910	342	31	63	185
S 21-8	669	20	56	116	40	119	5	41	888	349	37	71	183
S 21-10	743	20	55	114	42	113	5	33	910	321	35	49	187
S 24-1	820	54	60	78	55	78	5	95	2602	361	30	65	281
S 24-2	835	49	59	92	55	76	5	81	1232	371	34	41	267
S 24-4	736	40	193	130	43	103	5	54	1057	354	38	38	242
S 24-6	641	34	56	97	36	107	5	35	957	338	43	63	203
S 24-7	636	24	57	121	36	122	5	23	781	346	51	51	215
S 29-1	870	46	51	108	61	99	5	66	1032	402	30	60	256
S 29-3	770	58	60	152	44	105	5	147	978	379	23	60	216
S 29-5	782	51	57	76	47	75	5	58	2672	402	41	57	243
S 29-10	735	38	52	103	39	114	5	31	780	377	33	74	206
S 29-11	795	45	57	117	40	107	5	41	902	343	28	71	192
S2-2	816	44	46	177	44	179	41	47	1082	356	20	67	230
S13-1	809	20	50	118	52	144	14	36	3871	355	24	73	234
S6-2	687	27	62	137	41	106	37	44	857	366	15	74	194
S14-7	640	20	46	120	38	101	25	67	755	352	22	77	192
S12-6	722	25	59	136	40	120	34	50	830	374	14	79	198
S20-2	875	38	39	99	62	86	31	81	1326	350	25	64	254
S14-1	836	47	54	96	54	78	7	59	4649	338	20	69	272
S22-4-1	630	19	47	138	40	85	27	43	760	327	20	79	196
S25-4	537	20	42	134	38	101	36	45	674	340	23	10	187
S23-4-1	728	20	61	131	43	122	39	39	780	360	24	81	183

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Table 5.4 (cont.)

SAMPLE	Ba	Ce	Co	Cr	Nb	Ni	Pb	Rb	Sr	V	Y	Zn	Zr
S28-1	1003	36	52	99	60	72	40	106	1197	366	12	65	269
S25-2	773	31	52	111	47	65	39	52	1041	357	21	68	233
S28-3	685	21	54	113	43	83	39	42	880	341	15	73	185
S28-4	598	20	39	122	44	87	5	87	709	347	16	30	178
S27-11	752	20	57	155	40	88	49	49	825	374	19	79	199
N-1	1106	61	71	80	36	90	5	157	922	432	96	10	196
N-2	1132	43	72	94	39	65	5	190	1052	415	272	80	258
N-3	1111	39	56	100	36	45	34	86	962	444	25	90	243
N-4	1057	25	54	139	36	74	50	64	853	429	14	84	215
N-5	969	27	57	132	44	97	36	77	946	346	27	85	256
N-7	1099	56	165	84	36	88	5	112	1052	387	126	24	270
N-8	1087	63	66	148	42	110	5	198	951	368	325	49	264
N-9	1006	40	60	130	37	103	33	80	911	372	18	80	243
N-11	984	54	59	190	40	103	32	88	912	353	10	84	251
N-12	1020	49	53	151	41	111	5	186	970	363	308	58	219

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Table 5.5 Averages of trace element analyses of each basaltic flow from the Nam Cho and the Sop Prab-Ko Kha basalts.

Basaltic Terrain	Basaltic Flow	Ba	Ce	Co	Cr	Nb	Ni	Pb	Rb	Sr	V	Y	Zn	Zr
Nam Cho Basalt		1057.00	45.70	71.30	124.80	38.70	88.60	37.00	123.80	953.10	426.70	122.10	70.44	241.50
Sop Prap-Ko Kha Basalt	The fifth flow	843.45	41.18	50.45	108.55	54.45	105.36	34.33	78.00	1344.91	359.91	30.27	59.80	247.36
	The fourth flow	809.18	35.91	53.64	116.09	49.18	97.45	21.83	74.27	2067.55	357.73	32.09	62.64	238.64
	The third flow	726.36	32.73	64.82	109.73	43.82	97.91	33.29	86.36	1321.36	350.45	68.27	61.18	207.82
	The second flow	687.36	29.22	49.82	113.36	40.55	111.45	31.00	81.45	991.82	357.00	71.55	52.73	203.09
	The first flow	757.91	33.78	56.00	124.91	40.73	115.55	37.67	49.00	904.45	354.82	21.45	65.64	207.27

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Cr: Cr values of the Sop Prab - Ko Kha and the Nam Cho basalts range from 108 to 125 ppm and averaging 116.24 ppm.

Nb: The Nam Cho and the Sop Prab - Ko Kha basalts contain Nb contents ranging from 38 to 54 ppm with average 44.57 ppm.

Ni: Ni contents of the Nam Cho and the Sop Prab - Ko Kha basalts are ranging from 88 to 115 ppm, and averaging 102.72 ppm.

Pb: Pb values of the Sop Prab - Ko Kha and the Nam Cho basalts range from 21 to 38 ppm and average about 32.52 ppm.

Rb: Rb content of the Sop Prab - Ko Kha basalt is lower than those of the Nam Cho basalt. These contents range from 49 to 123 ppm and averaging 82.15 ppm.

Sr: The Sop Prab - Ko Kha and the Nam Cho basalts are composed of Sr contents ranging from 904 to 2,067 ppm and averaging 1,263.87 ppm.

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V: The Nam Cho and the Sop Prab - Ko Kha basalts contain V values ranging from 350 to 427 ppm, with averaging 367.77 ppm.

Y: The Nam Cho and the Sop Prab - Ko Kha basalts contain Y contents ranging from 21 to 122 ppm and averaging 57.62 ppm.

Zn: Zn values of the Nam Cho and the Sop Prab - Ko Kha basalts range from 52 to 70 ppm and average about 62.07 ppm.

Zr: Range of Zr for the Sop Prab - Ko Kha basalt is from 203 to 247 ppm. These values are lower than those of the Nam Cho basalt.

Fig. 5.9 depicts the variation of Nb versus Zr (in ppm) for the Sop Prab - Ko Kha and the Nam Cho basalts. Both basalts display a remarkably constant Zr/Nb ratio of 5.03, suggesting that both eruptives may represent the products of fractional crystallization. Fig. 5.10 shows the variation of Y/Nb versus Zr/Nb for these two basalts. A Sop Prab - Ko Kha basalt plot on an apparent mixing trend between an enriched component and a depleted MORB - source component, but close to enriched side. This provides a strong evidence for the rock of asthenosphere or MORB - source mantle in the petrogenesis of these two suites in an actively extending rift segments. It is likely that the very high ratio of some of the Nam Cho basalt represent an original source characteristic, not produced predominantly by crustal contamination (see Dungan et al., 1986, Wilson, 1989). However, detailed Sr-Nd-Pb isotopic data are clearly required to confirm the involvement of contamination by crustal materials in the petrogenesis.

Rare Earth Element Data

The analyses of rare earth elements of the selected 30 samples from the Nam Cho and the Sop Prab - Ko Kha basalts are present in Table 5.6. These analyses comprise La, Ce, Nd, Sm, Eu, Tb, Dy, and Lu. The rare earth elements (REE) are regarded as amongst the least soluble trace elements and are relatively immobile during low-grade metamorphism, weathering, and hydrothermal alteration (Rollinson, 1993). The REE analyses of each basaltic flow from both areas are normalized by the standardized chondrite (Sun, 1982). These chondrite normalized REE patterns are presented in Figs. 5.11 to 5.16. Almost all REE patterns of each basaltic flow layer from both areas roughly

Table 5.6 Rare earth element analyses (in ppm) of 30 selected samples for the Nam Cho and the Sop Prab-Ko Kha basalts.

Sample	La	Ce	Nd	Sm	Eu	Tb	Dy	Yb	Lu
S-2	33.67	66.38	19.28	5.98	1.66	0.51	3.78	1.93	0.22
S-4	38.56	64.80	28.91	6.11	2.41	0.55	4.13	2.90	0.28
S-8	42.86	79.82	41.70	6.80	1.53	0.63	4.17	2.12	0.25
S-11	37.29	72.65	32.02	5.86	1.61	0.48	3.91	2.38	0.25
S-13	43.13	80.12	34.63	6.52	2.58	0.66	4.05	2.02	0.28
S1-1	31.80	64.68	24.79	6.09	1.65	0.82	3.22	2.14	0.33
S1-7	30.72	60.30	31.40	6.34	1.79	0.48	3.75	2.24	0.25
S21-4-2	33.84	70.86	28.56	6.40	1.52	0.83	4.98	2.51	0.34
S21-6	26.87	57.17	23.23	5.33	1.14	0.54	4.36	2.14	0.24
S21-8	29.35	60.68	18.86	5.38	1.12	0.62	4.49	2.70	0.25
S21-10	27.82	57.80	26.21	5.05	1.69	0.71	3.55	2.59	0.29
S1-10	31.22	53.34	30.43	5.97	2.26	0.43	4.63	2.31	0.18
S24-1	41.11	83.56	33.70	6.52	1.50	0.63	4.07	2.19	0.27
S24-2	37.15	64.00	39.19	5.99	1.53	0.67	4.52	2.16	0.25
S24-4	34.78	74.52	28.94	6.24	1.55	0.56	4.25	2.12	0.34
S24-6	27.31	54.77	21.80	5.21	1.14	0.56	4.68	2.26	0.20
S24-7	29.88	56.93	30.19	5.77	1.74	0.63	4.59	2.67	0.34
S29-3	33.75	66.57	22.38	6.21	1.20	0.42	4.37	2.11	0.24
S29-10	30.45	60.60	26.61	5.72	1.40	0.49	3.81	2.57	0.27
S29-11	28.42	44.03	25.32	5.71	1.29	0.58	4.01	2.45	0.21
S14-7	31.28	59.48	28.54	5.75	1.20	0.62	3.80	2.71	0.26
S12-6	29.20	56.80	28.16	5.89	1.84	0.63	4.40	1.86	0.25
S20-2	38.64	71.20	30.60	5.80	1.47	0.60	4.56	2.13	0.27
S28-1	39.35	60.08	28.58	6.04	1.66	0.42	4.36	2.89	0.27
S28-3	29.24	54.50	17.88	5.59	1.79	0.43	3.94	2.54	0.27
N-1	43.09	83.53	58.24	6.72	1.67	0.68	4.46	2.66	0.25
N-5	53.45	108.98	41.37	8.05	1.50	0.80	5.14	2.89	0.28
N-7	53.72	106.90	44.46	8.20	2.05	0.67	4.27	2.96	0.20
N-9	47.61	77.42	42.63	7.94	1.61	0.55	3.98	2.60	0.31
N-12	49.63	82.37	34.05	7.55	1.81	0.82	4.36	2.17	0.21

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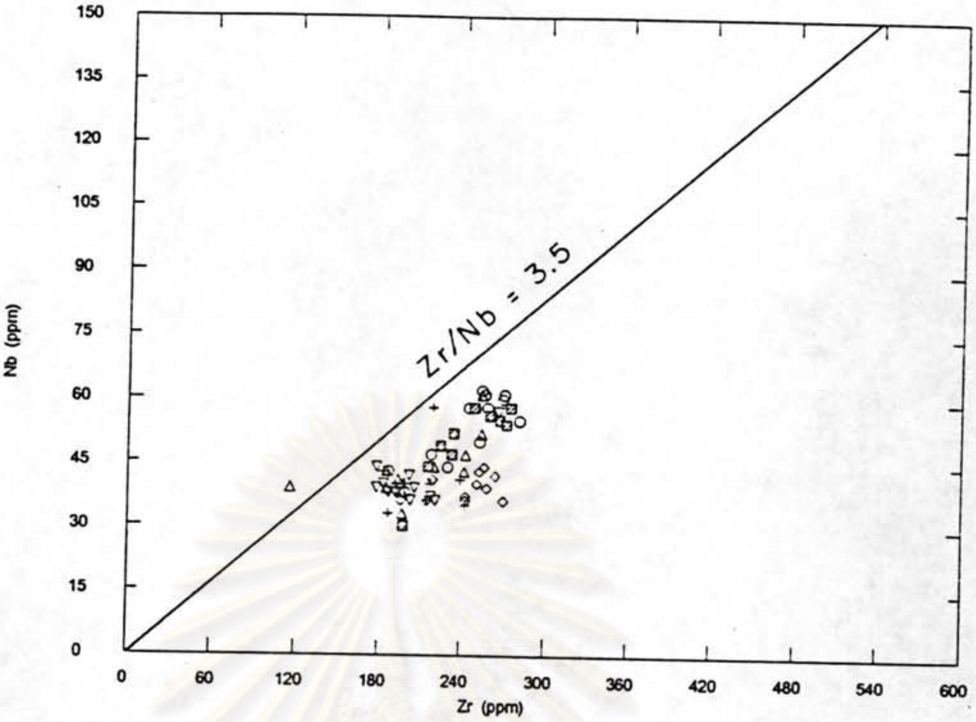

Fig.5.9. Variation of Nb versus Zr (ppm) for basalts from the study area.

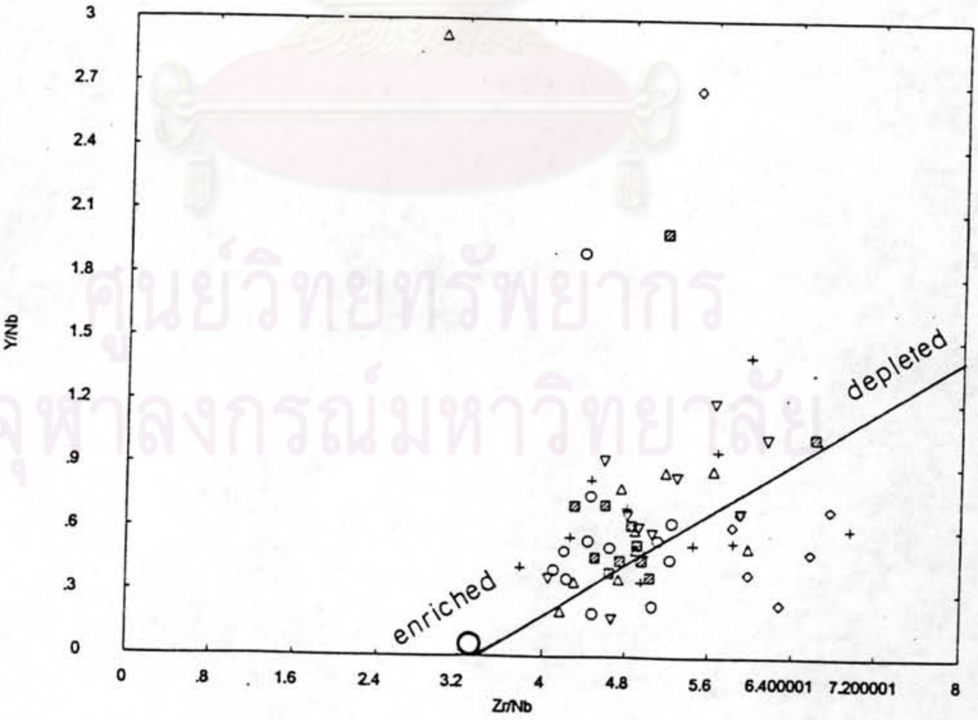

Fig.5.10. Variation of Y/Nb versus Zr/Nb for basalts from the study area and mixing trend line between an enriched MORB source component and a depleted MORB source component (Wilson, 1989).

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show similar trend (Figs. 5.11 to 5.16). They show steep slope with strong light rare earth enrichment that may indicate low degree of partial melting of the source rock (Rollinson, 1993). Heavy-REE abundances are only 5 times condritic for these two basaltic rocks, suggesting the presence of residual garnet in the sources.

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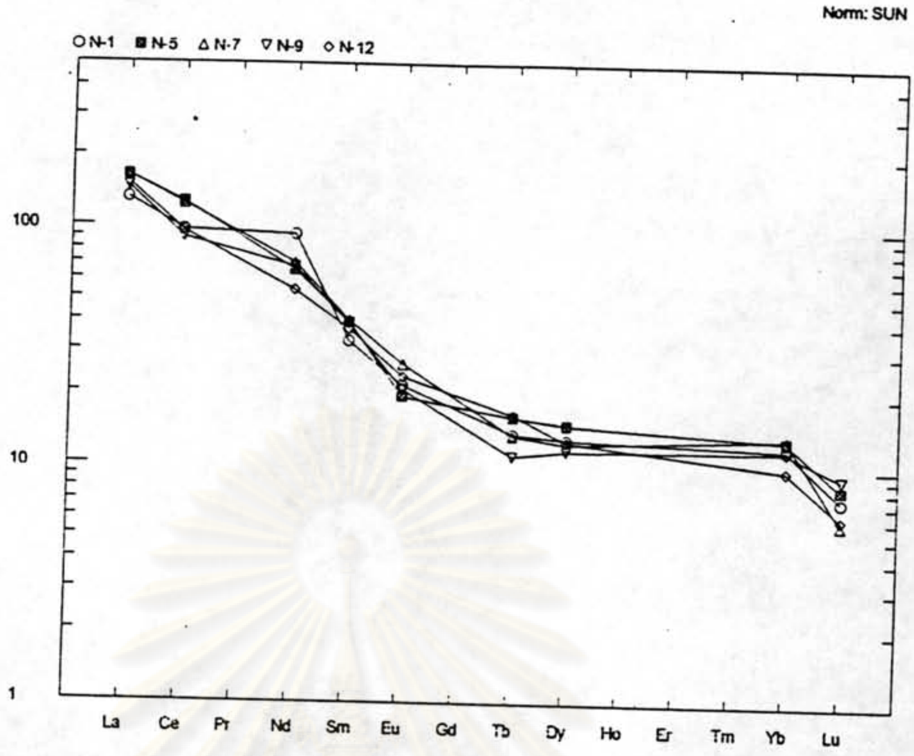

Fig.5.11. Chondrite normalized REE patterns of samples from the Nam Cho basalt.

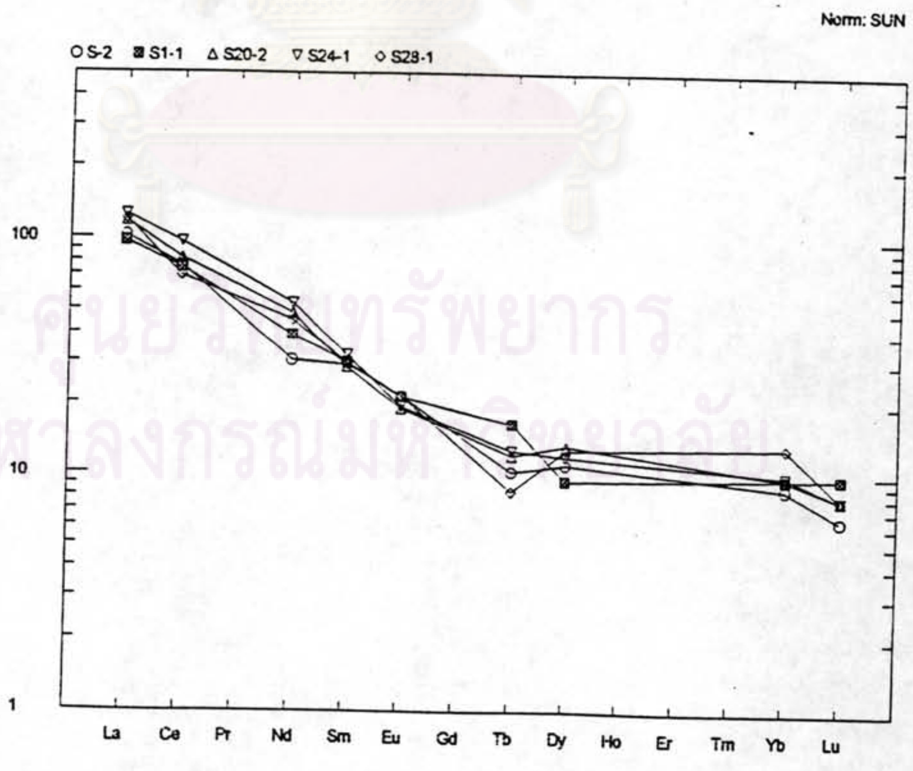

Fig.5.12. Chondrite normalized REE patterns of the fifth basaltic flow from the Sop Prab-Ko Kha area.

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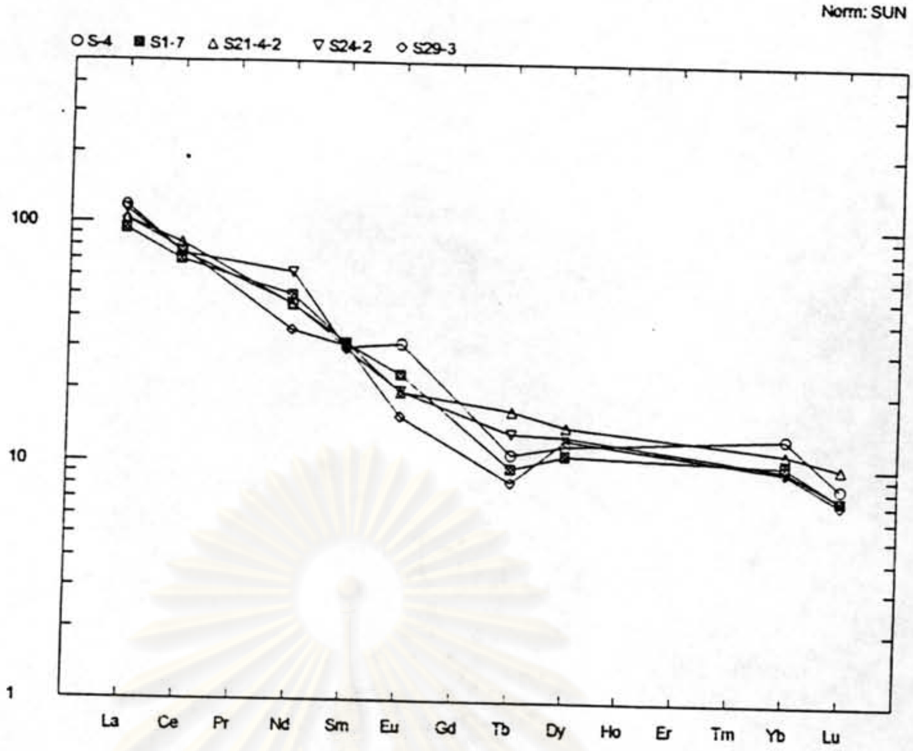

Fig.5.13. Chondrite normalized REE patterns of the fourth basaltic flow from the Sop Prab-Ko Kha area.

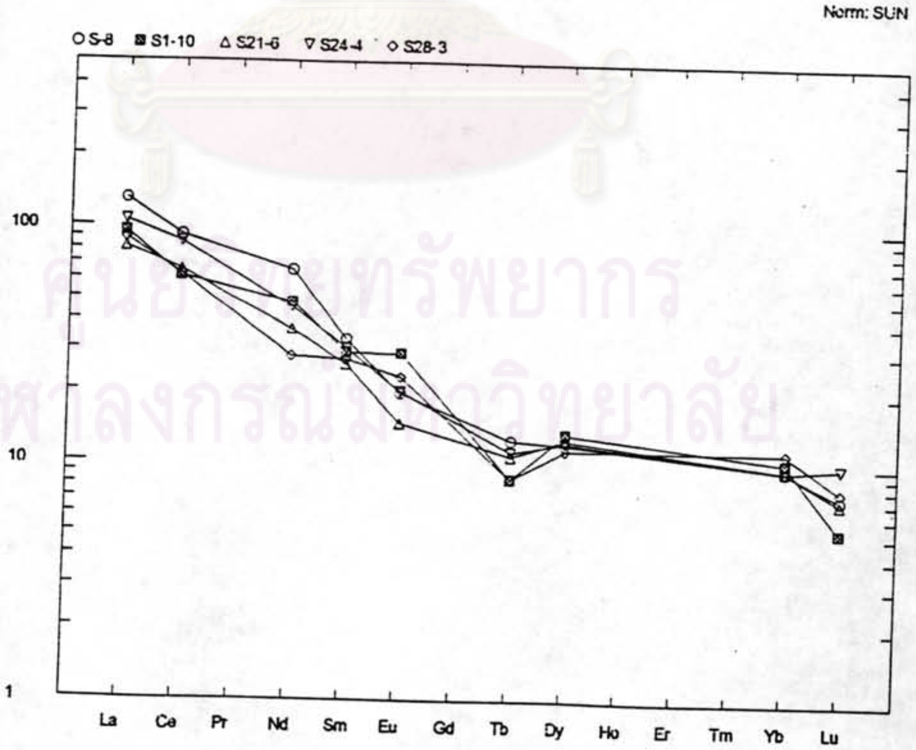

Fig.5.14. Chondrite normalized REE patterns of the third basaltic flow from the Sop Prab-KoKha area.

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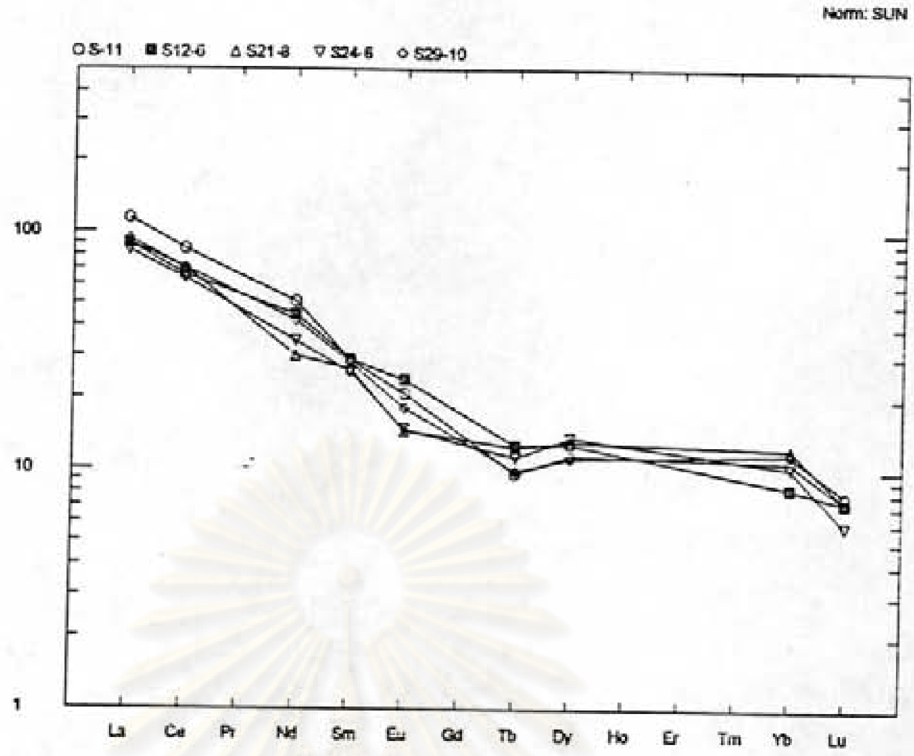

Fig.5.15. Chondrite normalized REE patterns of the second basaltic flow from the Sop Prab-Ko Kha area.

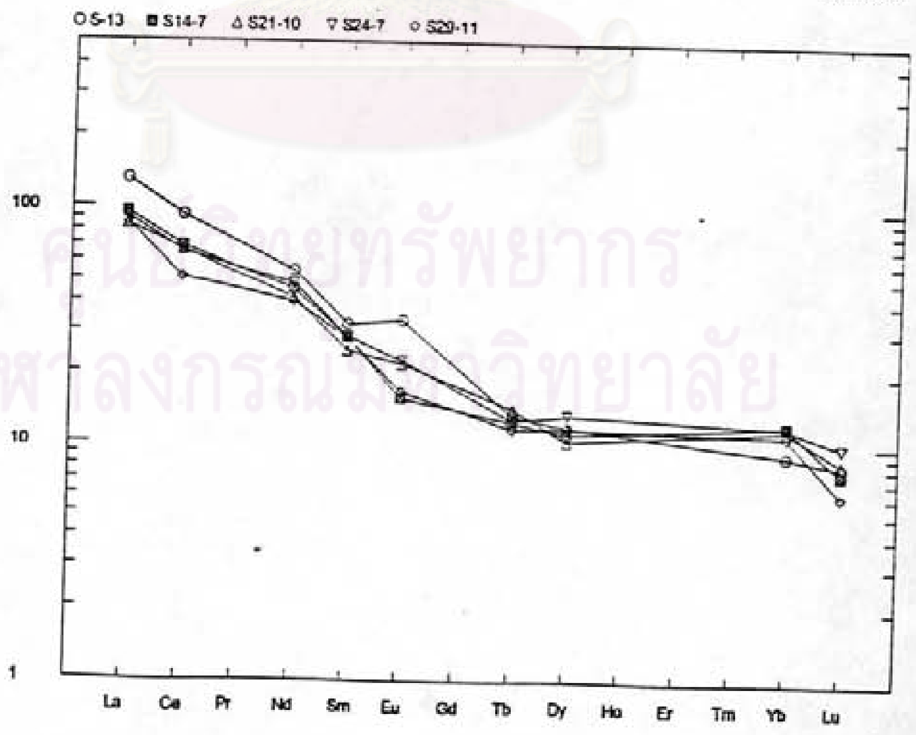

Fig.5.16. Chondrite normalized REE patterns of the first basaltic flow from the Sop Prab - Ko Kha area.

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