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COMPARATIVE STUDY ON GEOCHEMISTRY AND TECTONIC IMPLICATION IN TWO VOLCANIC ENVIRONMENTS: SINGU AREA AND KYAUKPHYU-WEBAUNG AREA, MANDALAY REGION

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Abstract

The objective of this paper is to present the main results of a comparative study of geochemistry and tectonic implication on Singu Area and Kyaukphyu-Webaung Area. The Singu area is composed mainly of the basaltic rocks from the younger lava of Singu Plateau. Singu Lava Plateau is made up of a thick pile of very fluid basaltic flows displaying segregation structure. They form a 100 km^2 plateau which overlies Mio-Pliocene sandstones as well as the upper part of the Irrawaddy Formation. Most basaltic rocks of Singu area are aphanitic, glassy, and pyroclastic rocks in which plagioclase and pyroxene are major constituents with subordinate amounts of olivine and Fe-Ti oxides. Basaltic rocks often show porphyritic, vesicular and trachytic texture. Major element data suggest that the Singu lava are predominantly of basaltic trachyandesite and show the alkaline nature. According to the immobile trace element concentrations, the basaltic rocks are dominated by alkali basalt. The trace element geochemistry suggests geochemical characteristic of Within-Plate Basalt. Lavas from the Singu area show a clear intraplate character with no subduction signal.

In Kyaukphyu-Webaung area, the basaltic rocks are mainly composed of olivine, plagioclase and pyroxene and minor amount of chrome spinel and opaque minerals. They show porphyritic, trachytic texture and reaction rims. According to the major element data, the volcanic rocks fall in tephrite, trachy basalt, basalt and basaltic andesite. They show tholeiitic and calc-alkaline character. The spider diagram of the basaltic rocks confirm that the basaltic lavas are originated from variable partial melting degrees of subduction-related mantle source and island arc nature. The trace element analyses of the basaltic rock samples indicate that these are having characteristics of either IAT or transitional between MORB and IAT and they have formed in supra-subduction zone tectonic setting. This suggests that there may be significant tectonic differences between Singu Area and Kyaukphyu-Webaung Area.

Keywords: alkaline nature, within-plate basalt, subduction related mantle, MORB and IAT

Introduction

The study area is situated between Singu and Kabwet in Mandalay division and Kyaukphyu-Webaung area in Thabeikkyin and Mongmit Township. This area lies within latitudes 22^o 32' N to 23^o 15'N and longitudes 95^o 56' E to 96^o 17'E. It covers part of 93-B/2, 84-N/14, 93-A/4 and 93-A/8 one inch topographic maps (Fig. 1). In the investigated area, tholeiitic, calc-alkaline and alkaline basaltic lavas display contrasted geochemical signatures. These are usually thought to reflect the contributions of variable partial melting degrees of subduction-related mantle source and island arc nature, or that of deep sub-oceanic or subcontinental intraplate mantle, respectively. The setting and origin of the Singu alkalic volcanics are also rather unusual. The case of Singu volcanics located along the Sagaing Fault is not of subduction related affinity, but is more likely to have derived from the melting of deep enriched mantle. The volcanic rocks of the Kyaukphyu-Webaung area can be due to modification of the depleted

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mantle by a subduction slab component or may be due to variable degree of mobilization during the alteration processes.

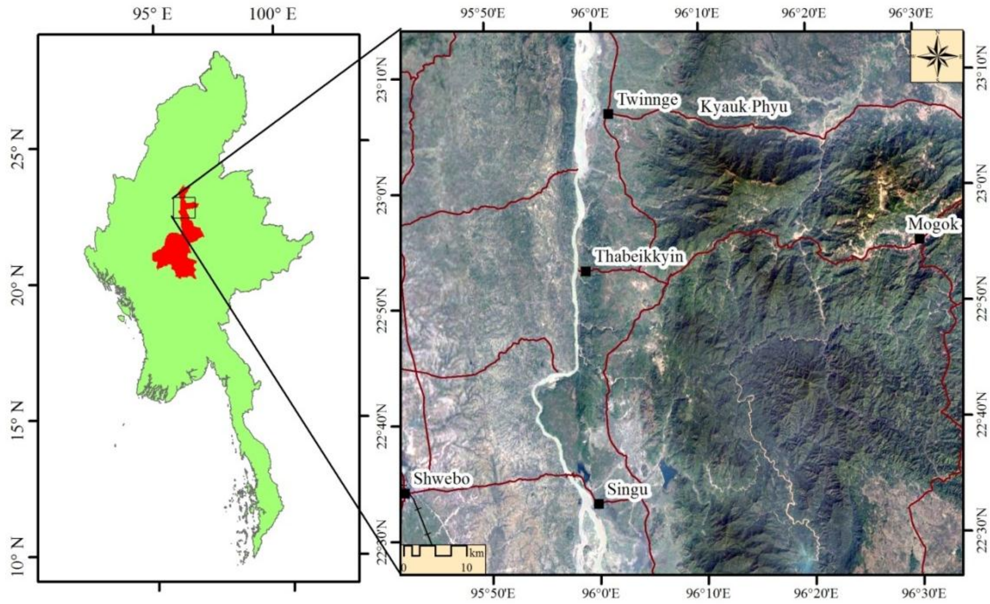

Figure 1 Location map of the Singu Area and Kyaukphyu-Webaung Area

Method of Study

Due to the lack of detailed geological map of the study area, mapping is carried out during the field season and the representative samples of rocks units were collected. The sample localities, lithologic boundaries and distinctive structural positions are located by using GPS.

The major oxides and trace elements of representative samples with reference to the X-ray fluorescence spectroscopy (XRF) data were tested at Geochemistry Laboratory, Applied Geology Department, Yangon University and Physics Department, Mandalay University.

Geochemical Studies

Singu Plateau is made of a thick pile of very fluid basaltic flows displaying segregation structures (Caroff *et al*., 2000). They form a 100 km^2 plateau which overlies Mio-Pliocene sandstones as well as the upper part of the Irrrawaddy formation (Chhibber, 1934; Bender, 1983). It has been offset by the Sagaing fault. These observations suggest a lack of very recent volcanic activity in the plateau, a feature in agreement with the 0.25 to 0.31 Ma ^{40}K-^{40}Ar ages of five basaltic samples (Bertrand *et al*., 1998).

The volcanic rocks in Kyaukphyu-Webaung Area are dacite, andesite, basaltic andesite, basalt, trachy basalt, tephrite and foidite. These rocks are well exposed at the western flank of Dokhta Taung, Ayo-O Taung and Shar Taung, Subok Taung, Nansein Taung, No.1 Taung, Thandaung and along the Nansein Chaung, Pyaunggyauk Chaung and Pinhet Chaung. The basalts in Kyaukphyu-Webaung Ophiolite fall in Tagaung-Myitkyina Belt. The ophiolite rocks from near Myitkyina indicate early Middle Jurassic zircon U-Pb ages of 171±173 Ma. (Liu *et.al*, 2016).

Rock Classification

In the study area, the fresh samples with L.O.I (Loss on Ignition) values lower than 2 wt. % are chosen. Most of the lavas from Singu and Kyaukphyu-Webaung are mafic lava and display rather low content in compatible trace elements (Cr, Co, Ni). In Le Bas *et al.* (1986) diagram (Fig. 2), the Singu lava plot within the fields of phonotephrite, basaltic trachyandesite and trachybasalt and it shows alkaline nature. However, the analyzed lava from Kyaukphyu-Webaung area plot within the field of foidite, tephrite, basanite and trachybasalt which are alkaline in nature and in basalt, basaltic andesite, andesite and dacite which display subalkaline/tholeiite nature according to Le Bas *et al*. (1986) diagram (TAS).

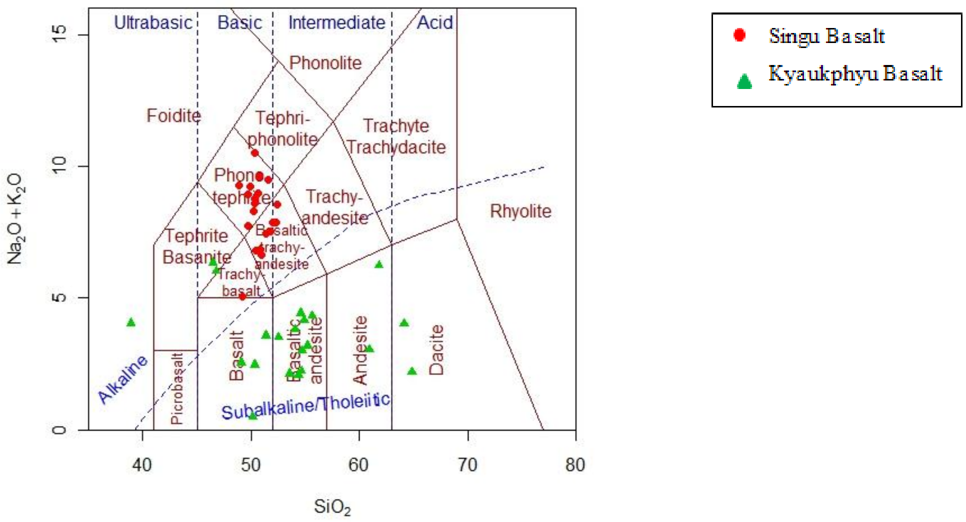

Figure 2 The total alkali versus silica (TAS) diagram of Le Bas *et al*. (1986)

In K_2O-SiO_2 diagram (Peccerillo and Taylor, 1976) (Fig. 3), the Singu lava plot within the field of Shoshonite Series and Kyaukphyu-Webaung lava plot within the field of Calc-alkaline Series and Tholeiite Series. In Na_2O-K_2O-CaO diagram (Fig. 4) the two lavas plot within the field of Sodic. The Singu lavas which display an "anorgenic" trace element signature, has been categorized as basaltic trachyandesite following their position in (Na_2O+K_2O) vs. SiO_2 diagram.

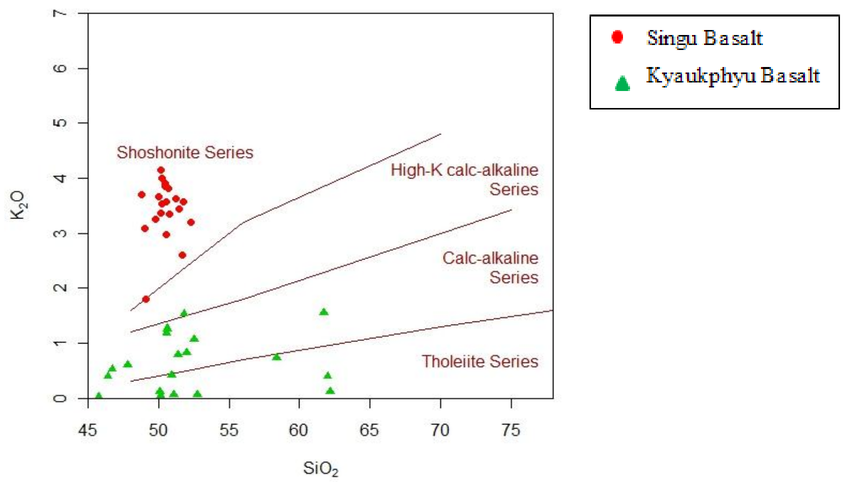

Figure 3 SiO_2 vs. K_2O plot showing the various series of basaltic rocks (Peccerillo and Taylor, 1976)

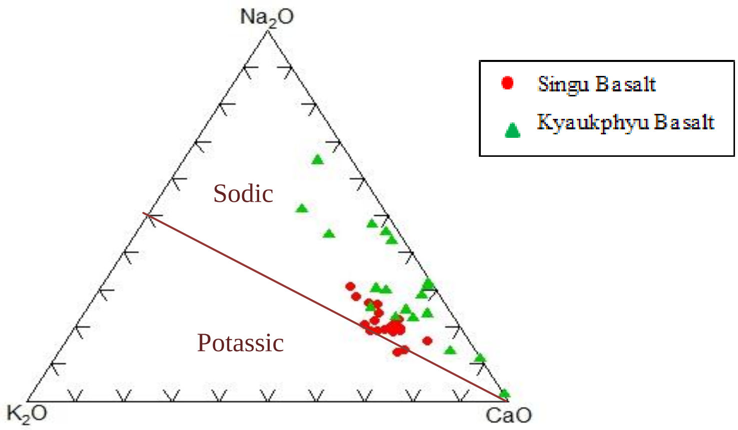

Figure 4 K_2O-Na_2O-CaO showing the alkali series of basaltic rocks (Green & Poldervaort, 1958)

Petrographic Notes

Singu basaltic trachyandesites display hypocrystalline, intergranular, intersertal, trachytic texture and subaphyric microlitic texture with less than 5% phenocryst of olivine and microphenocrysts of plagioclase (labradorite-andesine). Plagioclase microlites are long prismatic and they often show penetrated twin. Augite phenocrysts are surrounded by sub-parallel alignment of plagioclase microlites which show trachytic texture. Their groundmass is generally vesicular and contain olivine, plagioclase, augite and titanomagnetite.

The basaltic rocks in Kyaukphyu-Webaung area have highly porphyritic microlites texture with up to 25% of millimetric to centimetric phenocrysts. Some plagioclase often shows glomeroporphyritic texture and trachytic texture. These are, by order of decreasing abundance, Olivine often converted to serpentine and chlorite, plagioclase often converted to saussurite, sericite, augite and scarce chrome spinel. Some olivine crystals show quenched texture. Their groundmass contains augite granules, plagioclase microlites, opaque minerals and small amount of Cr-spinel. Oscillatory zoning occurs in some tabular phenocryst of plagioclase.

Major Element Characteristics

The major and trace elements of the studied lavas allow to distinguish two different groups, the first one comprising Singu lavas and the second one comprising Kyaukphyu-Webaung basaltic rocks. For instance, TiO_2 contents are close to 3% for Singu lavas and lower than 1.44% for the second group, a feature usually considered as typical of orogenic magmas. The former value fall within the range commonly observed for intraplate alkali basalts. The normative nepheline contents of Singu basaltic trachyandesites (less than 5%) allow to consider them as mildly alkalic lavas. Most of the Kyaukphyu-Webaung volcanic rocks are silica-saturated, with normative quartz contents increasing regularly from basalts to dacite (Table 1). Kyaukphyu-Webaung lava compositions define an almost continuous calc-alkaline series ranging from basalts to dacites through basaltic andesites and andesites.

Tectonic Implication

The geochemical signatures of the studied lavas document two contrasted tectonic environments for Singu lava and Kyaukphyu-Webaung basaltic rocks respectively. This is mainly based on the trace element characteristic of basaltic rocks (Table 2).

On a triangular plot of Zr/4, 2×Nb and Y (Fig. 5), Meschede (1986) showed that four main basalt fields can be identified. Within-plate alkali basalts plot in field A; within-plate tholeiites plot in fields AII and C. E- type MORB plots in field B whilst N- type MORB plots in field D. Volcanic-arc basalts also plot in fields C and D. The several areas of overlap mean that only within-plate alkali basalts and E- type MORB can be identified without ambiguity. According to this diagram, the basaltic rocks from the Singu area fall in within-plate alkali basalts (field A) and the basaltic rocks from the Kyaukphyu-Webaung area plot within N- type MORB and volcanic-arc basalts (field D).

Table 1 Major Oxides of the Basaltic Rocks of Singu Area and Kyaukphyu-Webaung Area

	Sample	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	H_2O	LOI	Total
SINGU AREA	B8	51.64	2.82	12.48	7.85	-	0.15	2.47	14.79	4.92	2.61	0.03	-	0.05	99.81
	C1	50.54	1.85	11.58	7.05	-	0.12	1.99	15.96	4.65	2.98	0.02	-	0.11	96.85
	I1	52.25	2.31	11.44	10.48	-	0.32	2.45	11.89	5.30	3.20	0.02	-	0.18	99.84
	I2	51.45	2.85	12.90	10.95	-	0.22	1.81	10.05	6.00	3.44	0.04	-	0.05	99.76
	J3	51.21	2.85	14.02	10.65	-	0.15	2.32	11.07	3.82	3.62	0.04	-	0.06	99.81
	J7	50.57	2.11	12.58	9.01	-	0.12	2.55	13.13	6.03	3.57	0.03	-	0.07	99.77
	J9	50.25	2.04	12.32	8.63	-	0.11	2.62	16.95	3.25	3.54	0.03	-	0.02	99.76
	J12	50.44	2.14	13.50	8.37	-	0.12	1.97	14.17	5.04	3.91	0.04	-	0.12	99.82
	J16	50.79	2.54	15.00	11.67	-	0.14	2.26	10.66	3.28	3.35	0.03	-	0.11	99.83
	K1	49.74	2.17	12.30	9.61	-	0.14	2.80	13.70	5.95	3.25	0.02	-	0.07	99.75
	K2	50.44	2.17	14.93	5.31	-	0.11	2.38	17.06	5.21	3.86	0.03	-	0.12	101.62
	K3	49.06	0.57	17.93	4.31	-	0.46	7.38	15.06	3.23	1.81	0.01	-	0.14	99.96
	K5	49.04	1.04	11.62	10.07	-	0.16	2.84	16.28	4.58	3.08	0.02	-	0.10	98.83
	L2	50.18	2.13	12.33	9.79	-	0.13	2.63	13.76	5.37	3.37	0.02	-	0.17	99.88
	L4	48.77	2.04	11.89	7.88	-	0.11	2.11	17.62	5.55	3.70	0.03	-	0.28	99.98
	L5	50.20	2.29	13.43	8.67	-	0.12	2.13	12.33	6.46	4.01	0.04	-	0.06	99.74
	L7	51.76	2.13	12.82	8.47	-	0.11	2.20	14.29	4.28	3.57	0.03	-	0.11	99.77
	L10	50.00	2.06	12.44	8.14	-	0.11	2.13	16.47	4.62	3.66	0.03	-	0.12	99.78
	L13	50.66	2.14	13.74	8.14	-	0.11	2.00	16.07	3.02	3.81	0.04	-	0.24	99.97
	SG	50.13	2.21	13.10	8.49	-	0.11	2.39	14.65	4.40	4.15	0.04	-	0.04	99.71
KYAUKPHYU- WEBAUNG AREA	3152	62.16	0.69	13.75	-	9.16	0.20	5.46	2.26	1.98	0.12	0.09	4.04	-	99.91
	25026	61.98	1.09	13.77	-	8.79	0.19	5.24	1.51	3.49	0.39	0.24	3.22	-	99.90
	2804	61.70	0.40	19.00	2.76	2.64	0.15	2.56	4.19	4.67	1.55	0.24	0.00	-	99.86
	2606	58.38	1.44	15.19	4.31	4.69	0.38	6.67	1.33	2.19	0.73	0.54	4.10	-	99.96
	2608	52.76	1.39	14.57	5.83	7.45	0.30	8.40	4.17	1.96	0.06	0.13	2.80	-	99.82
	27 (A)	52.50	0.86	16.86	-	8.84	0.19	4.87	6.02	3.00	1.07	0.13	5.33	-	99.67
	28 (A)	51.98	1.02	15.73	-	11.57	0.30	4.49	5.88	2.17	0.82	0.15	5.76	-	99.87
	2806	51.80	0.76	17.30	-	9.73	0.29	4.82	5.59	2.39	1.53	0.19	5.48	-	99.88
	28(B)	51.38	1.04	15.65	-	11.69	0.31	4.71	6.24	2.02	0.79	0.16	5.89	-	99.87
	2607 L	51.05	1.22	13.95	-	12.76	0.26	7.70	4.30	2.01	0.06	0.12	6.41	-	99.85
	2605	50.89	1.31	13.74	-	14.99	0.31	4.98	7.10	2.97	0.41	0.14	2.62	-	99.46
	2802	50.59	0.71	16.17	4.04	5.60	0.26	5.87	6.67	2.30	1.26	0.10	0.17	-	93.74
	616	50.57	0.86	16.46	-	9.16	0.26	5.64	5.48	2.90	1.19	0.20	7.17	-	99.88
	2607 R	50.12	1.25	14.29	-	13.41	0.28	8.04	4.16	1.93	0.05	0.12	6.17	-	99.82
	2607	50.10	1.15	17.10	6.44	8.86	0.27	8.00	5.12	2.33	0.12	0.12	0.00	-	99.61
	2801	47.79	1.27	14.26	4.69	7.07	0.32	5.76	8.32	2.72	0.60	0.21	6.84	-	99.85
	2606 a	46.70	0.46	21.40	4.69	7.31	0.41	7.25	5.52	5.47	0.53	0.15	0.00	-	99.89
	2606 b	46.40	0.54	20.90	4.14	6.46	0.38	7.20	7.44	5.94	0.39	0.13	0.00	-	99.92
	2902 a	45.75	0.57	9.64	2.64	4.15	0.14	2.39	25.41	0.43	0.01	0.09	8.62	-	99.84
	27 B	43.74	0.60	14.88	-	9.09	0.22	8.45	9.77	1.62	0.65	0.06	10.80	-	99.89
	2902 b	38.80	0.63	12.50	2.88	5.81	0.30	4.11	30.50	3.90	0.13	0.25	0.00	-	99.81

Table 2 Minor and Trace Elements of the Basaltic Rocks of Singu Area and Kyaukphyu-Webaung Area

	Sample	Ni	Co	Cr	Cu	Zn	V	La	Rb	Ba	Sr	Pb	Zr	Nb	Ta	Y	S	As	Mo	Cl
SINGU AREA	B8	34.6	10.9	35.9	56.1	172	202	<2.0	65.7	855	833.8	6.3	330.8	37.8	-	28.5	330.6	<0.	<1.0	-
	C1	25.6	7.8	45.7	36.1	149.1	114	<2.0	86.2	1162	971	14.3	383.6	54.4	-	22.9	202.4	<0.	<1.0	-
	I1	36.6	736	38.5	44.8	169.5	123	<2.0	87.4	1308	1201	10.4	376.3	61.3	-	36.2	237	<0.	<1.0	-
	I2	41.5	8	30.3	48.7	157	191	<2.0	87.4	1308	1201	10.7	376.3	61.3	-	36.2	266.9	<0.	<1.0	-
	J3	36.2	9.4	31.3	56.3	158.8	230	131	92.1	1199	1015	11.2	384.9	62.5	-	30.7	302.3	<0.	<1.0	-
	J7	40.6	8.1	46.8	36.5	160.2	628.	<2.0	113.	1560	1050	8.2	443.8	68	-	29.6	245.3	<0.	<1.0	-
	J9	32.6	11.6	35.3	35.8	131.1	164	<2.0	96	1151	938.1	6.5	383.6	57.6	-	24.4	243.8	<0.	<1.0	-
	J12	30.6	8.2	33.1	37.4	138.7	115	139	117.	1673	1103	11.5	439.6	64.3	-	26.6	285.7	<0.	<1.0	-
	J16	39.2	13.7	42.8	45	165.9	153	<2.0	83.7	1479	929.7	5.2	417.2	65.1	-	27.8	39.8	<0.	<1.0	-
	K1	41.3	7.9	35.3	39.7	159.4	119	70	94.1	1285	1008	17.9	462.8	76.2	-	25	274.6	<0.	<1.0	-
	K2	30.9	7.1	31.1	38.9	130	175	<2.0	108.	1247	990.2	-	430.8	63.8	-	24.4	18.8	<0.	<1.0	-
	K3	23	<3.0	65.4	16.4	84.2	109	155	85.3	646	542.6	-	276.4	13.1	-	30.3	<2.0	<0.	<1.0	-
	K5	33.8	13	37.5	35.5	154.1	110	<2.0	87.3	1181	954.2	-	393.3	53.8	-	23.3	273.8	<0.	<1.0	-
	L2	33.9	11.5	53.5	38.7	152.4	143	<2.0	102.	1197	975.2	-	392.7	63.8	-	25.5	260.8	<0.	<1.0	-
	L4	28.1	9.9	25.9	39.1	131.2	148	<2.0	107.	1329	1192	-	414.6	61.1	-	27.7	242.1	<0.	<1.0	-
	L5	35.5	10.9	33.9	40	146	305	<2.0	115.	1618	1224	-	472.5	78.3	-	25.8	271.5	<0.	<1.0	-
	L7	27.7	10.1	29.5	36.6	136.2	133	<2.0	94.6	1753	1161	-	397.5	57.2	-	27.3	261.7	<0.	<1.0	-
	L10	28.9	13	29.6	31.4	133.1	266	90	99.2	1760	1287	-	404	58.8	-	21.7	243.9	<0.	<1.0	-
	L13	26.4	8	42	35	126.3	167	109	104	1168	974.2	-	402.3	62.4	-	23.1	283.2	<0.	<1.0	-
	SG	31.5	11.7	34.3	38.6	137.3	140	<2.0	120.	1445	1096	-	477.4	73.2	-	24.5	251.5	<0.	<1.0	-
KYAUKPHYU- WEBAUNG AREA	3152	6	16	9	48	182	125	-	1	0	142	0	173	5	0	54	145	4	0	6
	25026	3	11	0	67	99	276	-	1	56	104	2	79	1	0	39	285	0	1	-
	2804	-	-	-	-	99		-	-	-	91	-	137	-	-	38	98	-	-	182
	2606	2	40	0	3	137	92	-	8	146	48	0	110	1	0	44	203	0	0	-
	2608	8	37	8	168	143	542	-	1	44	129	0	79	1	0	37	639	0	0	-
	27 (A)	12	38	8	12	83	274	-	18	438	243	0	67	3	0	30	2043	0	0	-
	28 (A)	1	63	1	181	116	353	-	10	116	211	0	70	2	0	31	177	0	0	-
	2806	2	32	0	72	79	233	-	16	178	331	0	58	2	0	23	168	2	0	2
	28(B)	2	46	0	184	118	357	-	9	73	217	3	71	3	0	32	190	0	0	-
	2607 L	6	33	9	188	128	461	-	0	38	118	1	67	1	0	32	404	0	0	-
	2605	2	41	13	413	131	619	-	6	152	287	5	67	1	0	35	3466	2	0	-
	2802	11	53	11	159	87	351	-	14	305	385	0	36	2	0	22	246	0	0	-
	616	31	64	82	23	77	263	-	20	67	184	0	78	3	0	27	180	0	0	-
	2607 R	7	42	17	158	136	487	-	0	32	125	1	70	3	0	35	670	0	0	-
	2607	-	-	-	232	179	600	-	-	-	153	-	101			56	300	-	-	124
	2801	0	62	0	32	99	394	-	5	243	203	3	57	1	0	36	457	0	0	-
	2606 a	-	-	-	-	200	314	-	-	-	292	-	-	-	-	-	66	-	-	-
	2606 b	-	-	15	-	216		-	-	-	399	-	-	-	-	-	211	-	-	137
	2902 a	62	47	365	593	27	275	-	3	0	27	1	37	1	0	16	161	0	0	-
	27 B	65	64	74	100	81	290	-	13	81	183	2	49	1	0	18	124	0	0	-

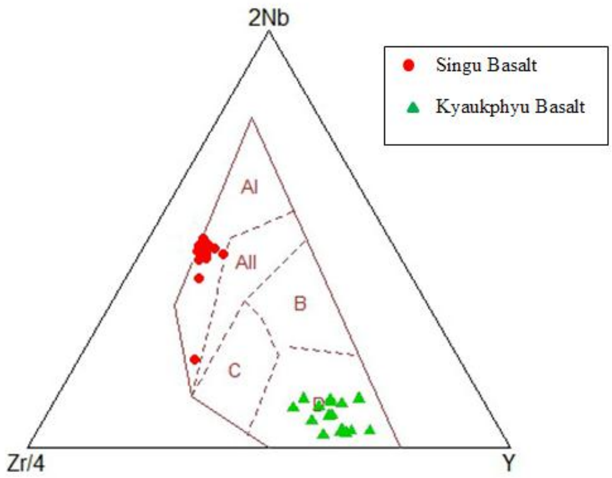

Figure 5 The ternary plot of Zr/4-2Nb-Y of Meschede (1986) showing tectonic setting of basaltic rocks

In the Cr versus Y diagram (Pearce, 1996), Cr is compatible in the mineral olivine, orthopyroxene and clinopyroxene and the spinels in a basaltic melt. The low levels of Cr in volcanic-arc rocks therefore are either a function of a different amount of mantle melting from MORB and/ or a difference in the fractionation history. The precise cause is difficult to define. Y is also depleted in island – arc basalts relative to other basalt types, for a given degree of fractionation. Thus a Cr vs. Y plot (Figure 6) discriminates effectively between MORB and volcanic arc basalts, with only a small amount of overlap between the two fields. Within-plate basalts, on the other hand, overlap the fields of MORB and volcanic- arc basalts. The wide range of Cr values in the volcanic-arc basalt field is most efficiently obtained through crystal fractionation, indicating that Cr is a useful fractionation index in these rocks. According to this discrimination diagram, the Singu volcanics belong to within-plate basalts (WPB) and the Kyaukphyu-Webaung volcanics fall in volcanic-arc basalts (VAB) and midoceanic ridge basalts (MORB).

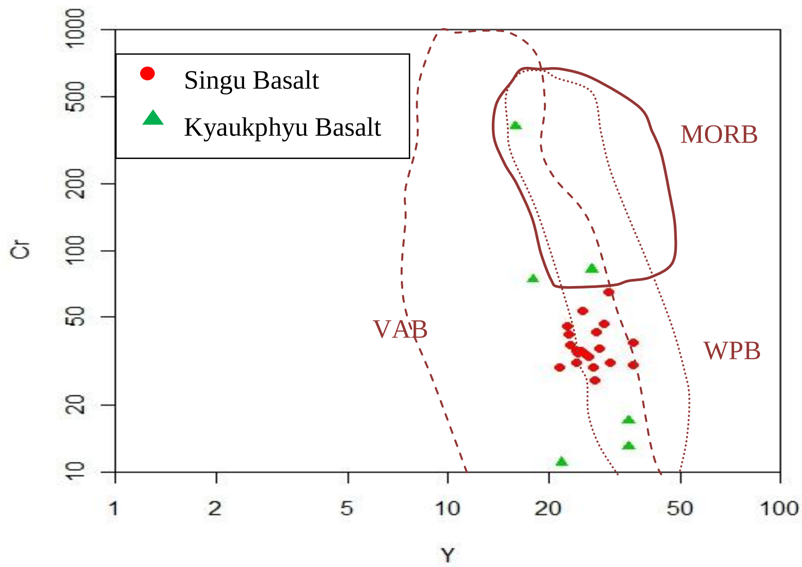

Figure 6 Tectonic discrimination Cr vs. Y diagram of the basaltic rocks (Pearce, 1982)

The Zr/Y versus Zr diagram (Figure 7) successfully separates the Within- Plate Basalts group from Mid-Oceanic Ridge Basalts and Island Arc Basalts. Within-Plate Basalts have higher Zr/Y and higher Zr than the other types of basalt, suggesting the enriched mantle source relative to the source of Mid-Oceanic Ridge Basalts and Island Arc Basalts (Rollinson, 1996). On this tectonic discrimination diagram, the Singu Volcanics have trace element characteristic of within-plate setting and the Kyaukphyu-Webaung volcanics belong to Island Arc and Mid-Oceanic Ridge settings.

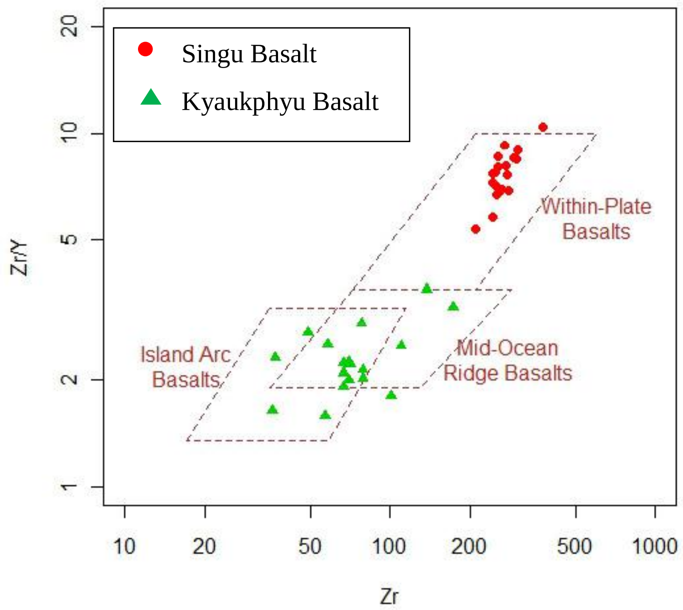

Figure 7 Zr-Zr/Y binary diagram showing tectonic setting of basaltic rocks (Pearce and Norry, 1979)

According to these diagrams the two volcanic areas have rather different tectonic environments. The Singu basaltic rocks form in within plate environment and the basaltic rocks from Kyaukphyu-Webaung area form in an oceanic environment and within either Island Arc or Mid-Oceanic Ridge.

Discussion

Evidence for contrasted mantle sources

The petrologic and geochemical signatures of the studied lavas document two contrasted magmatic affinities for Singu lava and for Kyaukphyu-Webaung basaltic rocks, respectively. The former group displays the features typical of deep enriched intraplate-type mantle source. Volcanism in the Singu area did not seem to have directly related to the subduction. In this area pre- existing crustal structures would serve pathways for the ascent of mafic alkaline melts. Lavas under investigation suggest intraplate character with no clear subduction signal. On the other hand, the geochronologic data presented in this study, indicate that the mafic alkaline pulse occured at 0.25-0.31 Ma suggesting that a common regional mechanism served to trigger melting at the mantle. In this region, the volcanic pulse was short and of limited volume. This is consistent with a thermal origin for enriched mantle melting because this region was underlain by a dry mantle unaffected by subduction. In this work the Singu plateau is considered as a surface reflection of a mantle hot spot on a moving lithospheric plate.

The geochemical signature of the Singu alkaline mafic basaltic trachyandesites which are offset by the Sagaing Fault suggests that they derive from the melting of deep enriched intraplate-type mantle, similar to the source of common Plio-Quaternary alkali basalts and related rocks from the Sundaland. Rapid uprise of high temperature alkaline magmas derived from the melting of enriched Sundaland-type mantle and channelled by Neogene fault planes parallel to the Sagaing Fault led to the emplacement of the Singu lavas. More rarely, it has been proposed that alkaline magmas could be emplaced along major transcurrent lithospheric faults, e.g. the Trans-Alboran lineament [Hernandez et al., 1987; de Larouziere et al., 1988], which would channel towards the surface magmas derived from distinct mantle sources (Maury et al., 2004).

The Kyaukphyu Webaung basaltic lava displays the features typical of "orogenic" magmas derived from the partial melting of metasomatised mantle carrying a subduction imprint. These basalts are generally considered as part of paleoceanic crust formed through magma derived from depleted mantle (DM) (Dey et.al., 2018). The enrichment in LIL elements in the volcanic rocks of the study area can be due to modification of the depleted mantle by a subducted slab component or may be due to variable degree of mobilization during the alteration processes. However, the enrichment of Ba and depletion of Nb relative to other incompatible elements are considered to represent the addition of subduction zone component (in Kakar, 2012).

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