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PRELIMINARY REPORT ON KIKIKTAT MOUNTAIN: A KLIPPE OF BASALTS, CHERTS, AND CALCAREOUS ARKOSIC SEDIMENTS IN THE NORTHERN BROOKS RANGE, ALASKA

By

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INTRODUCTION

Kikiktat and West Kikiktat Mountains, collectively known as Kikiktat Mountain, on the west side of the Killik River on the north flank of the Brooks Range, are an isolated pair of basalt-capped mountains in the Killik River quadrangle. Interlayered shales and calcareous arkosic sandstone together form an allochthonous klippe. This klippe is the uppermost of the imbricated thrust sheets of the Brooks Range.

The tholeiitic basalts consist of plagioclase, clinopyroxene, opaques, and alteration minerals, and are silica saturated to oversaturated. The interlayered cherts are generally greyish and recrystallized. Correlation of these basalts with ultramafic and mafic ophiolitic complexes elsewhere in the Brooks Range is tempting, but inconclusive based on available data. The underlying sedimentary section contains interbedded shales and sandstones. The sandstones are very calcareous and contain clastic grains of quartz and feldspar. Plant stem fragments, and invertebrate microfossils are common in the sandstones, and suggest a Paleozoic age for the sediments.

REGIONAL SETTING

Of the many thrust sheets that comprise the Brooks Range, the structurally uppermost tectonic package consists of an ophiolitic sequence of ultramafics, cumulate gabbros, basalts and cherts. This sequence is thought to have obducted from the south in Juro-Cretaceous times, over a minimum distance of 120 km (Roeder and Mull, 1978). Two discrete terranes, one of gabbro and dunite, the other of basalt, were stacked in inverse order during obduction (Mull, 1982). The mafic volcanics and gabbros of the Angayucham terrane in the southern Brooks Range, and several ophiolitic klippen (for example, Siniktanneyak Mountain, Misheguk Mountain, and Avan Hills) in the western Brooks Range, as well as the Christian Complex in the eastern Brooks Range, and the Innoko and Tozitna terranes and Rampart Group of the southern Yukon and Koyukuk basins have all been attributed to this obducted thrust package (Dillon, 1985; Roeder and Mull, 1978). On the basis of stratigraphic and structural setting, and composition of basalt and chert, it may be possible to correlate the rocks of Kikiktat Mountain with the basaltic portion of this ophiolitic thrust sheet. However, little data is available with which to make definitive correlations.

FIELD OBSERVATIONS

Of the nearly 2,000 vertical ft of topographic relief of Kikiktat Mountain, approximately 1,500 ft is comprised of basalt with scattered lenses and discontinuous layers of chert. The basalt is dark green, locally magnetic, has brownish-reddish weathered surfaces, is unfoliated and blocky,

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with extensive brittle fracturing. In general, deformation has made individual flows indiscernible, though forms suggestive of pillows are not uncommon. A well-exposed but inaccessible layer with columnar jointing is visible on the eastern cliffs of West Kikiktat. There is an overall layered pattern to the basalts, and intervals of chert indicate that the Kikiktat basalts, and intervals of chert indicate that the Kikiktat basalts occurred at least in part as oceanic flows. No gabbros or ultramafics were seen in the unit. The overall sense of layering in the mountain is in the form of a synclinal warp.

One to 2 mm round bluish-greenish milky blebs occur in basalts locally, especially near chert horizons. These are interpreted as alteration resulting from fluids driven from the cherts upon eruption of the basalts. Secondary minerals in fractures and veins are common; these include clear euhedral quartz crystals up to 2 cm long, and pale green prehnite crystals in aggregates 1 to 2 cm thick, and calcite. In several areas, maroon, black, and green shaley horizons occur, with associated turquoise-blue cherty zones. Rare tiny feldspar crystals and lithic fragments resembling lapilli suggest that these are tuffaceous layers between the basalt flows.

The cherts within the basalt unit are typically black to grey, but green-grey, blue-grey, maroon, and turquoise-blue cherts are also present. All tend to have a white-weathered surface. No chert horizon was seen to extend uninterrupted for more than about 30 to 50 meters. This is probably due to deformation within the unit during obduction. Broken nodules and blocks of chert surrounded by basalt may be a result of disruption during emplacement of the basalt flows. Elsewhere, folding of chert lenses and intense shearing in surrounding basalt suggests that the cherts have been structurally broken and deformed after the basalts cooled.

Deformation is predominantly brittle on Kikiktat Mountain. Intense brittle fracture is prevalent in the basalts, with and without secondary mineral infilling. Shear bands within basalts and cherts are thin (.5-2 mm), with irregular crosscutting orientations. Mineral fibers across fractures are bent, but not deformed, indicating growth in a changing stress field. Some fault planes are filled with non-foliated cataclasite and reaction minerals indicating fluid flux along the fault zone.

Below the basalts and cherts of Kikiktat and West Kikiktat Mountains is a unit of shales and calcareous arkosic sandstone, which was measured to be at least 30 meters thick. There is no evidence for faulting along the contact between this unit and the overlying basalt. The uppermost sandstone becomes silicified and grades into a chert at the contact; there is an increase in iron oxide at the contact in both chert and basalt, and a dark homogeneous margin in the basalt is probably an altered chill zone. A small (1 cm) clast of calc-sandstone was seen incorporated within the lower basalt, probably plucked up when the basalt flowed over the sediments. Figure 3 is a measured section of this unit, exposed in 'Dutweiller Canyon' on the western side of Kikiktat Mountain. The sandstones are grey, calcareous, fine- to coarse- grained, with clasts of quartz and feldspar. Shaley rip-ups are common. Upper surfaces of some beds are undulatory; plane and ripple laminations, laminated cross-beds, starved ripples and burrows are all features of the sandstone beds.

The shales are grey, fissile, and phyllitic near the structural bottom of the unit. Some shales are calcareous; sandstone lenses and limestone nodules are common. Abundant plant fragments occur in some sandstone beds. Only plant stems of indeterminate age were found. Invertebrate fossils are abundant in the calcareous sandstone layers.

Deformation of the calc-sandstone unit is characterized by small-scale kink folding in the shales (wavelength about 1 cm), slip along bedding planes - which is perhaps responsible for disruption of thin lensoid sandstones in the shaley layers, and by later brittle normal slip faults. Deformation seems to increase toward the lower part of the unit, and though not exposed, the lower contact of the sandstone-shale unit with underlying basalts is probably a fault. Structurally beneath the sedimentary package are more basalts and cherts. This lower section of basalt appears to be only a few flows thick with well-developed slickensides between many of the layers, suggesting structural repetition. Wherever exposed, the lower contact of the lowermost basalt is faulted, supporting the interpretation of Kikiktat Mountain as a thrust klippe. The klippe overlies Paleozoic sedimentary rocks which are familiar from the local stratigraphy, including interbedded black chert and limestone, and blue-grey chert. On West Kikiktat, dark green conglomerate and sandstone with clasts of black and blue chert occur between basalt layers. This layer is similar in appearance to nearby Cretaceous conglomerates/ and is interpreted as a fault sliver within the basalt sheet, though contact relations are not clear.

PETROGRAPHY AND ANALYTICAL DATA

Basalt

The Kikiktat basalts are modally quite uniform throughout the map area. They consist primarily of plagioclase, clinopyroxene and opaques. Secondary green micaceous alteration minerals (celadonite?) and titanite, some in euhedral forms, suggest pseudomorphing of primary olivine. Other alteration minerals include iron oxide, chlorite, biotite, calcite, sericite, epidote, and opaque. The degree of alteration varies, with the freshest samples having ≤1 percent secondary minerals, and the least fresh being nearly all alteration minerals. No glass is recognizable in thin section. Results of point counts of six thin sections (400 counts each) are shown in table 1, and plotted in figure 4. Average modal percentages are : 53 percent plagioclase (predominantly labradorite), 37 percent augite, 0.05 percent opaques (including magnetite, ilmenite(?), and pyrrhotite), and 0.05 percent possible olivine pseudomorphs. The basalts are aphanitic to fine-grained, some with phenocrysts of clinopyroxene and/or plagioclase up to about 5 mm. There is no foliation; textures are generally intersertal. Major oxide analyses of nine representative basalts from Kikiktat Mountain and two similar basalts from a knob east of the Killik River are shown in Table 2, with accompanying CIPW norm calculations for each sample. Four of the 11 samples are quartz normative, the other seven are olivine normative; none are nepheline normative. According to Yoder and Tilley's (1962) classification scheme, the samples are tholeiites and olivine tholeiites. A variation diagram plotting $Na_2O + K_2O$ versus SiO_2 shows a spread in alkalies over a small range in SiO_2. Using the Macdonald and Katsura (1964) classification the samples span the tholeiite to alkali basalt fields. On a triangular AFM diagram (fig 6), the samples show a high relative proportion of iron, typical of the tholeiitic suite. Microprobe analyses of clinopyroxenes shows them to be typical augites. When pyroxene compositions are plotted on the discriminant diagrams of Nisbet and Pearce (1977), they fall within both the ocean floor basalt field and the fields representing pyroxenes from all tectonic settings, making tectonic interpretation based on pyroxene composition ambiguous. The possibility of alkali mobility in these basalts cannot be discounted due to the presence of at least small amounts of alteration in all of the basalt thin sections.

Calc-arkosic Sandstones

Thin sections of sandstone layers from the unit directly beneath the basalts reveal clasts of quartz, alkali feldspar, plagioclase, opaque, up to 45 percent modal carbonate, and trace amounts of zircon, ±biotite, ±white mica, ±chlorite, ±titanite, and hematite. Small altered volcanic rock fragments occur in some layers. Alkali feldspar grains include microcline and perthite, subrounded, up to 3 mm diameter. Quartz is highly strained, with extensive subgrain development and recrystallization of some grains. Plagioclase is present in variable amounts, and tends to be smaller than the alkali feldspar grains. There is no metamorphic foliation evident in the samples. Most sandy layers contain invertebrate fossil fragments. These include foraminifera, bryozoa, brachiopods, trilobites, ostracods, and pelmatozoan debris. Micritic filling within bryozoa fragments indicates that at least some of these fossils have been reworked.

DISCUSSION

The fossil assemblage present in the calc-arkosic sandstone unit strongly suggests a late Paleozoic age for these sediments. This is permissive evidence, though obviously not definitive, for correlation with the Carboniferous Nuka Formation further west in the Brooks Range. The similar-looking Nuka Formation, at its type locality at Nuka Ridge, consists of quartz, alkali feldspar, calcite, opaques, ±biotite, ±hornblende, ±zircon, ±fossils. Source rocks for the clastic grains of the Nuka Formation and the Kikiktat sediments are granites; the Kikiktat source was apparently a subsolvus granite, probably containing biotite ±muscovite. The type Nuka rocks appear to be derived from a hypersolvus granite (no calcic plagioclase), containing biotite ±hornblende. Microcline from the latter rocks has been dated by K-Ar at 1.2 - 1.8 Ba. (Tailleur, 1985).

The Kikiktat sediments were deposited in a Paleozoic marine setting, probably continental shelf, perhaps continental slope. The overlying basalts and cherts were also formed in a marine environment, although the occurrence of columnar jointing suggests local subaerial cooling. The age of crystallization of the Kikiktat basalts remains uncertain. Cretaceous K-Ar ages of a similar allochthonous mafic complex to the west have been reported by Boak and others (1985). Similar ages for corresponding metamorphic contact aureoles lead the authors to the interpretation that the K-Ar ages of the Misheguk sequence gabbros and diorites represent resetting due to post-igneous thermal metamorphism. It seems clear at Kikiktat that the basalts flowed over the arkosic sandstone and shales---the existence and duration of any time hiatus is unknown.

The allochthonous nature of the sandstone±shale and basalt±chert package on Kikiktat Mountain is indicated by faulted contacts of the lowermost layers. The overall structural style is brittle deformation, with locally extensive shear zones. The oceanic character of the basalts is evident by the interlayering with chert. Whether these rocks are part of an ophiolite sequence is not definitive, based on the limited assemblage present, but they could conceivably be part of a dismembered ophiolite. Trace element data are forthcoming with which to further characterize the Kikiktat Mountain basalts. Correlation with other mafic bodies in the Brooks Range must await more detailed structural, petrologic and chemical data of the various occurrences.

ACKNOWLEDGMENTS

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REFERENCES CITED

Boak, J.L., Turner, D.L., Wallace, W.K., and Moore, T.E., 1985, K-Ar ages of allochthonous mafic and ultramafic complexes and their metamorphic aureoles, western Brooks Range, Alaska: [abs.] in Association Round Table, AAPG Bulletin, v. 69, p. 656-657.

Dillon, J.T., 1985, chapter 6. Structure and stratigraphy of southern Brooks Range and northern Koyukuk Basin near Dalton Highway; in AAPG Brooks Range field trip guidebook.

Irvine, T.N., and Baragar, W.R.A., 1971, A guide to the chemical classification of the common volcanic rocks: Can.J.Earth Science, v. 8, p. 523-548.

Macdonald, G.A., and Katsura, T., 1964, Chemical composition of Hawaiian lavas; J. Petrology, v. 5, p. 82-133.

Mull, C.G., 1982, Tectonic evolution and structural style of the Brooks Range, Alaska: an illustrated summary; in Geological studies on the Cordilleran thrust belt, Powers, R.B., ed., Rocky Mountain Association of Geologists, v. 1, p. 1-46.

Nisbet, E.G., and Pearce, J.A., 1977, Clinopyroxene composition in mafic lavas from different tectonic settings; Contrib. Mineral. Petrol., v. 63, p. 149-160.

Roeder, D., and Mull, C.G., 1978, Tectonics of Brooks Range ophiolites, Alaska; AAPG, v. 62, p. 1696-1713.

Streckeisen, A.L., 1973, Plutonic rocks: classification and nomenclature recommended by the IUGS subcommission on the systematics of igneous rocks; Geotimes, p. 26-30.

Tailleur, I., 1985, Letter to the editor; in Reverberations, Alaska Geological Society Newsletter, Hankins, H., ed., v. 15, n. 2, p. 4.
Yoder, H.S., and Tilley, C.E., 1962, Origin of basalt magmas: an experimental study of natural and synthetic rock systems; J. Petrology, v. 3, p. 342-532.

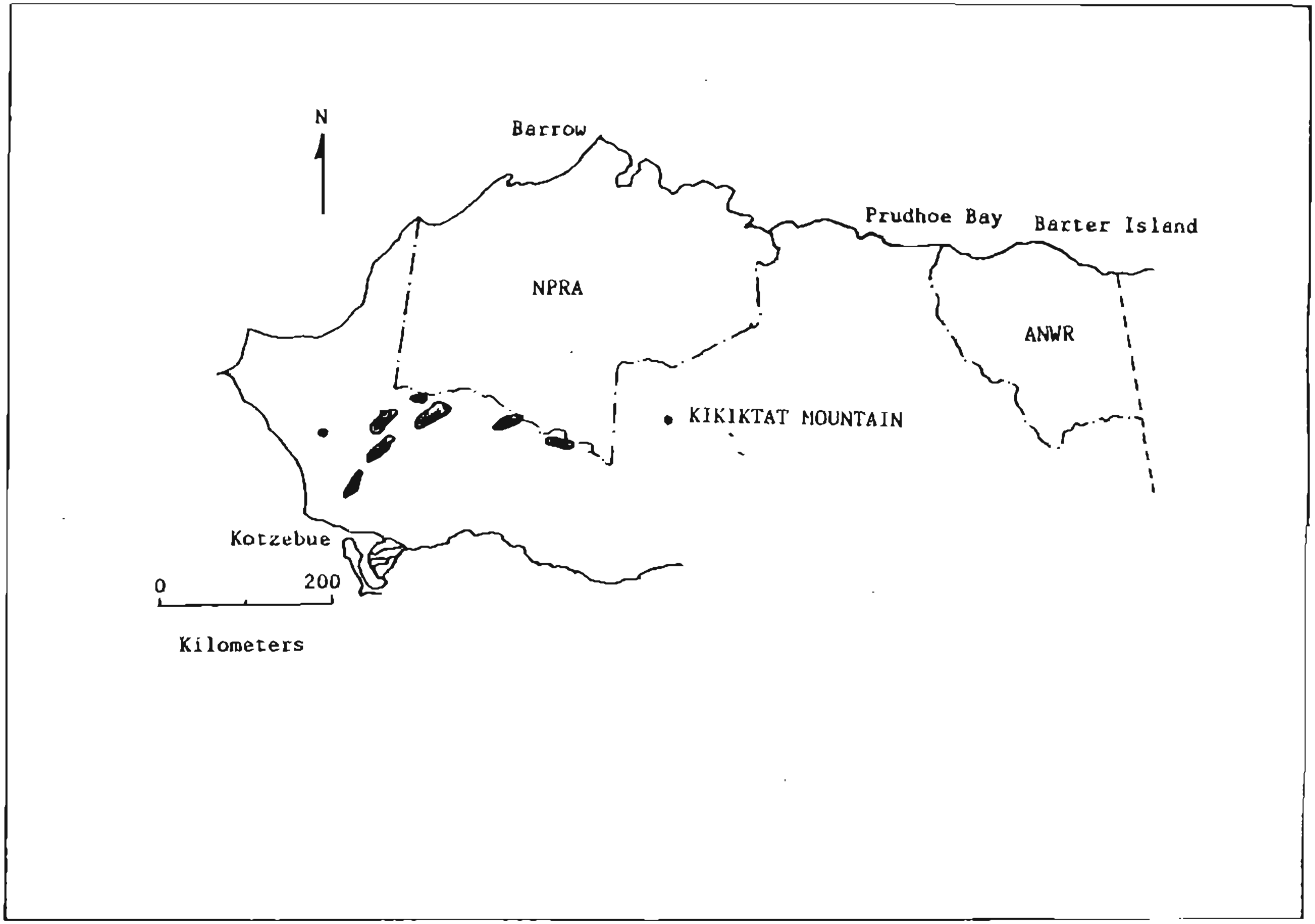

Figure 1. Location map showing Kikiktat Mountain. Shaded areas are other Brooks Range ophiolitic bodies.

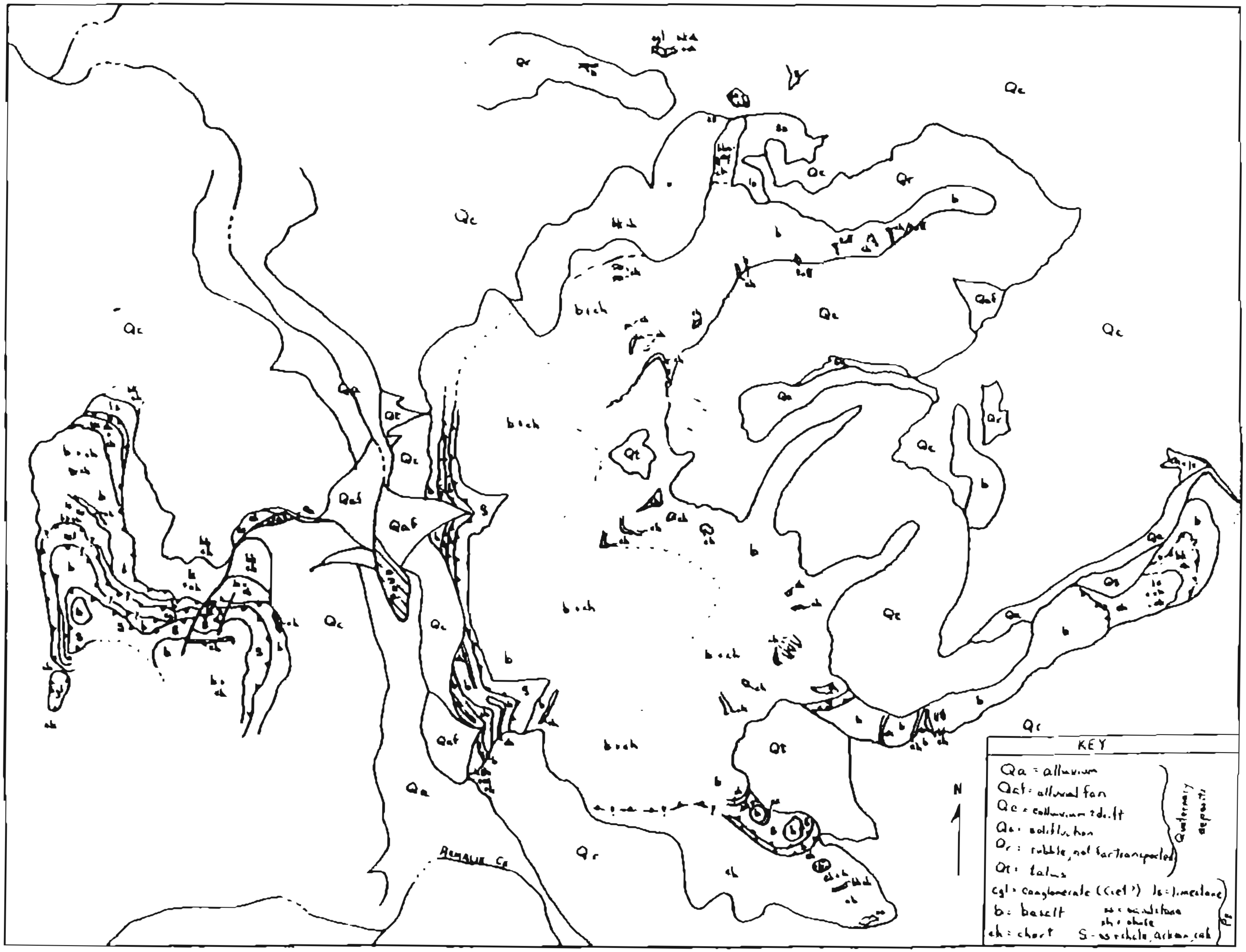

Figure 2. Map of Kikiktat Mountain area.

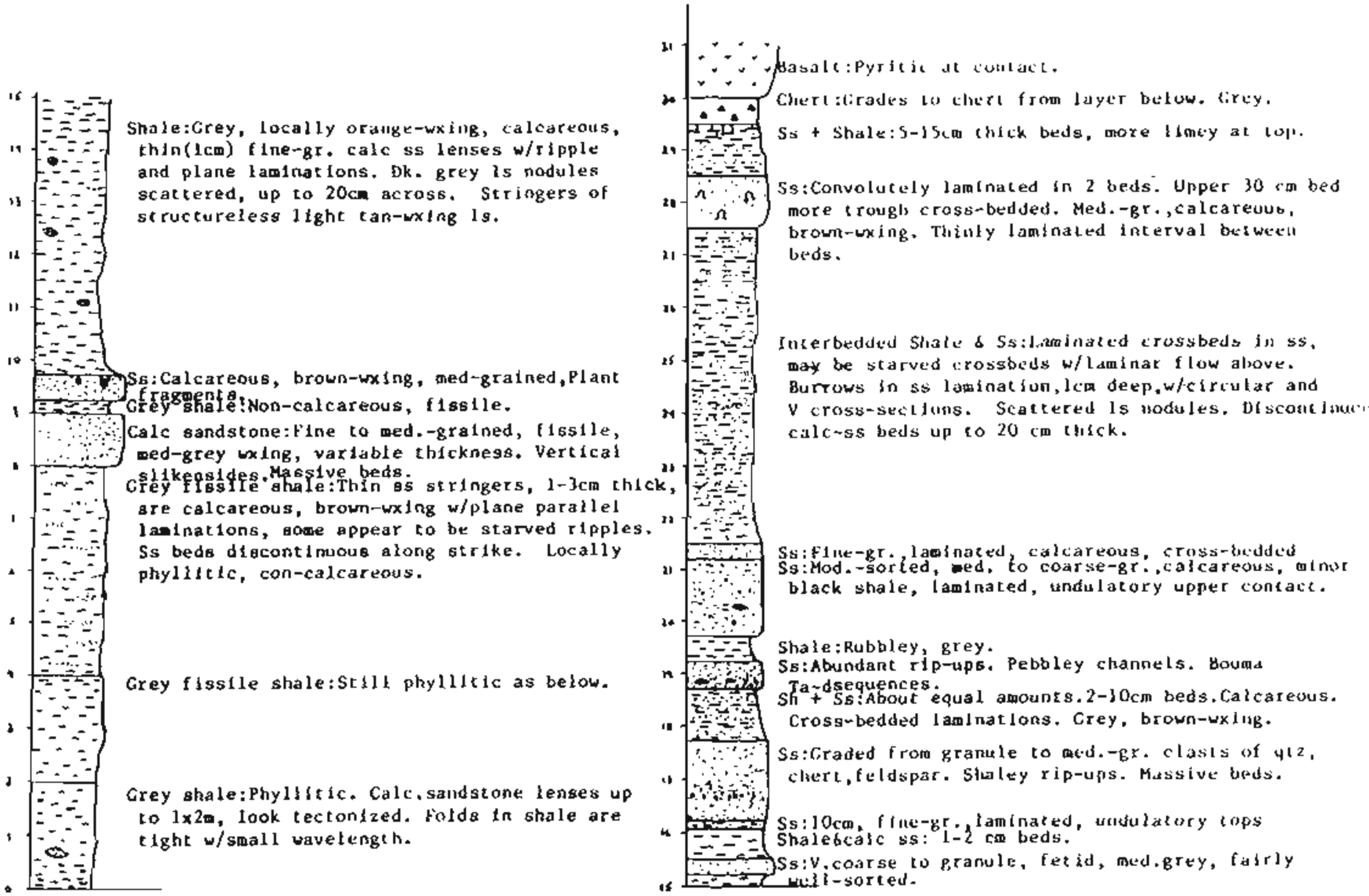

Figure 3. Measured section of sedimentary section underlying Kikiktat Mountain basalts.

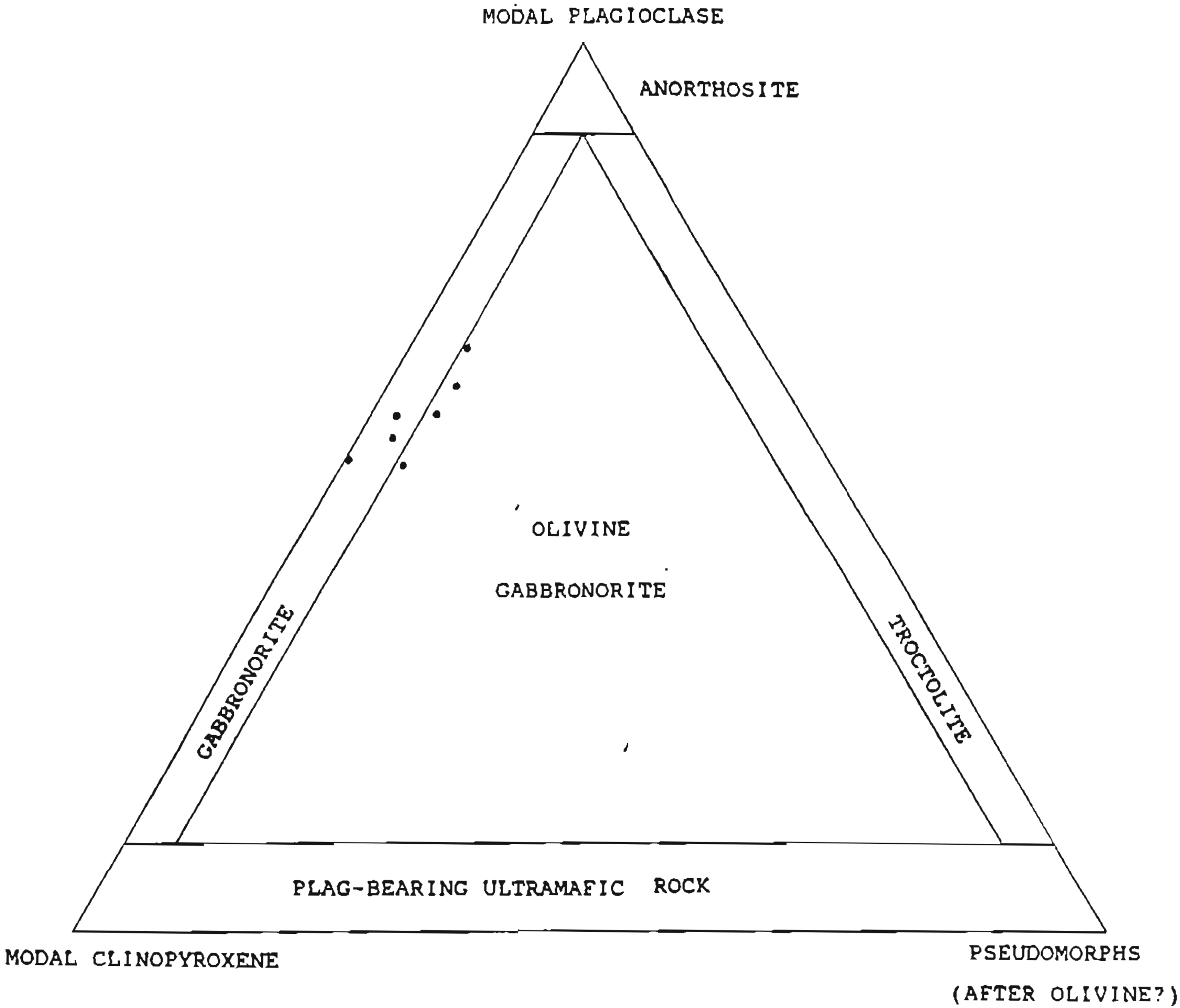

Figure 4. Basalt modal point count data, plotted in terms of plutonic classification scheme (Streckeisen, 1973).

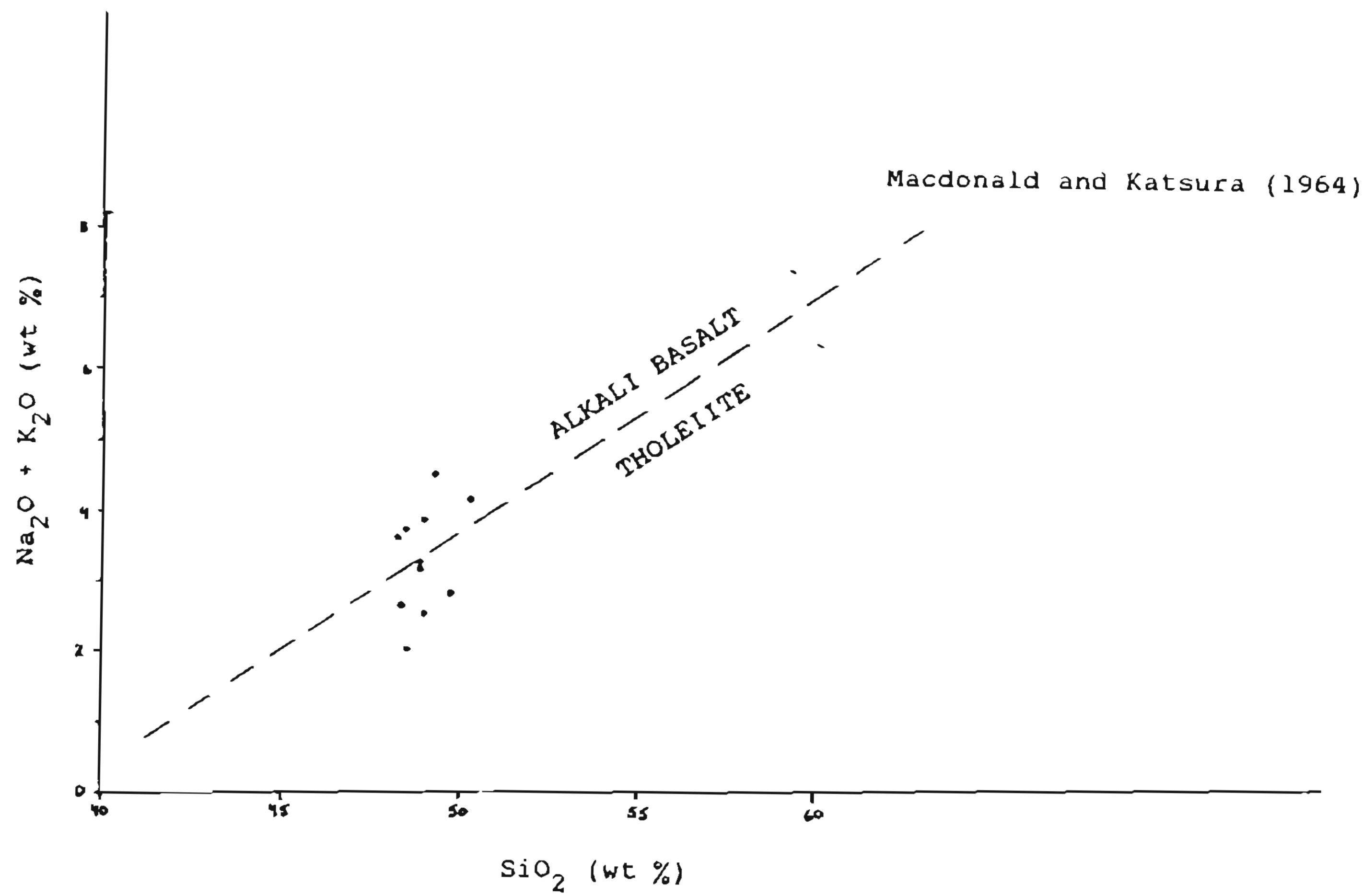

Figure 5. Variation diagram of Kikiktat basalts, plotting Na_2O+K_2O vs. SiO_2.

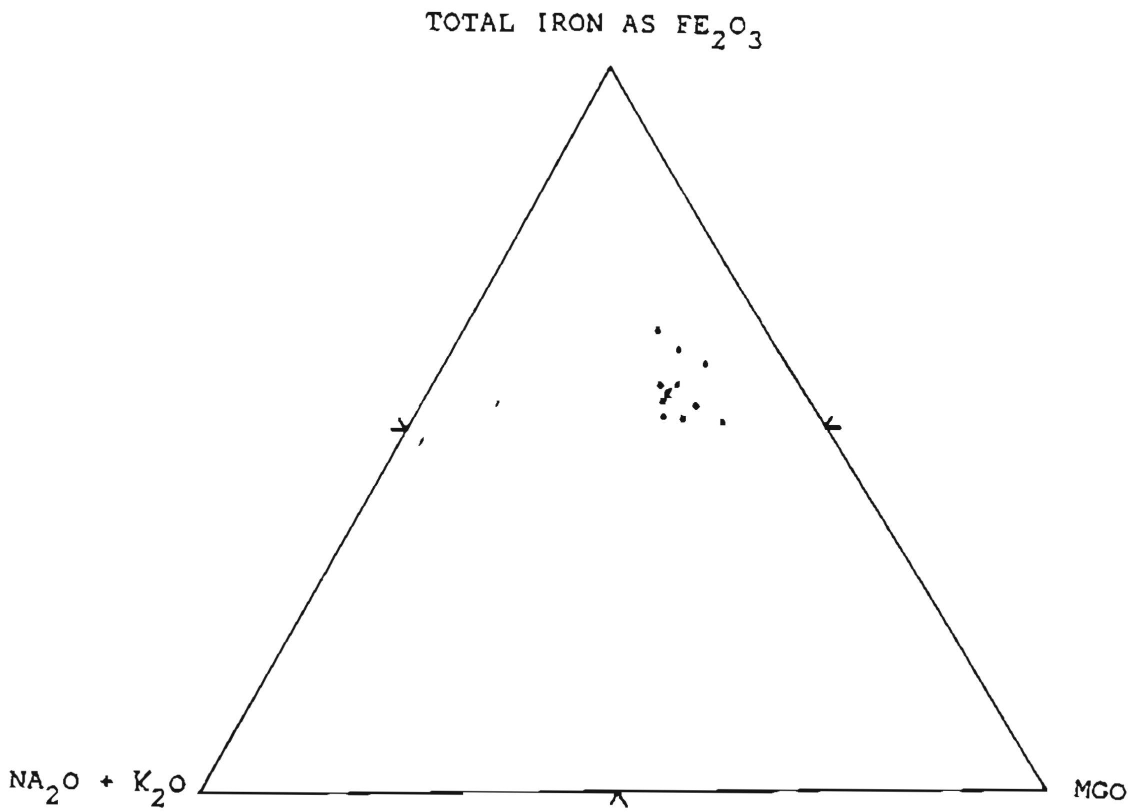

Figure 6. AFM diagram of Kikiktat basalts.

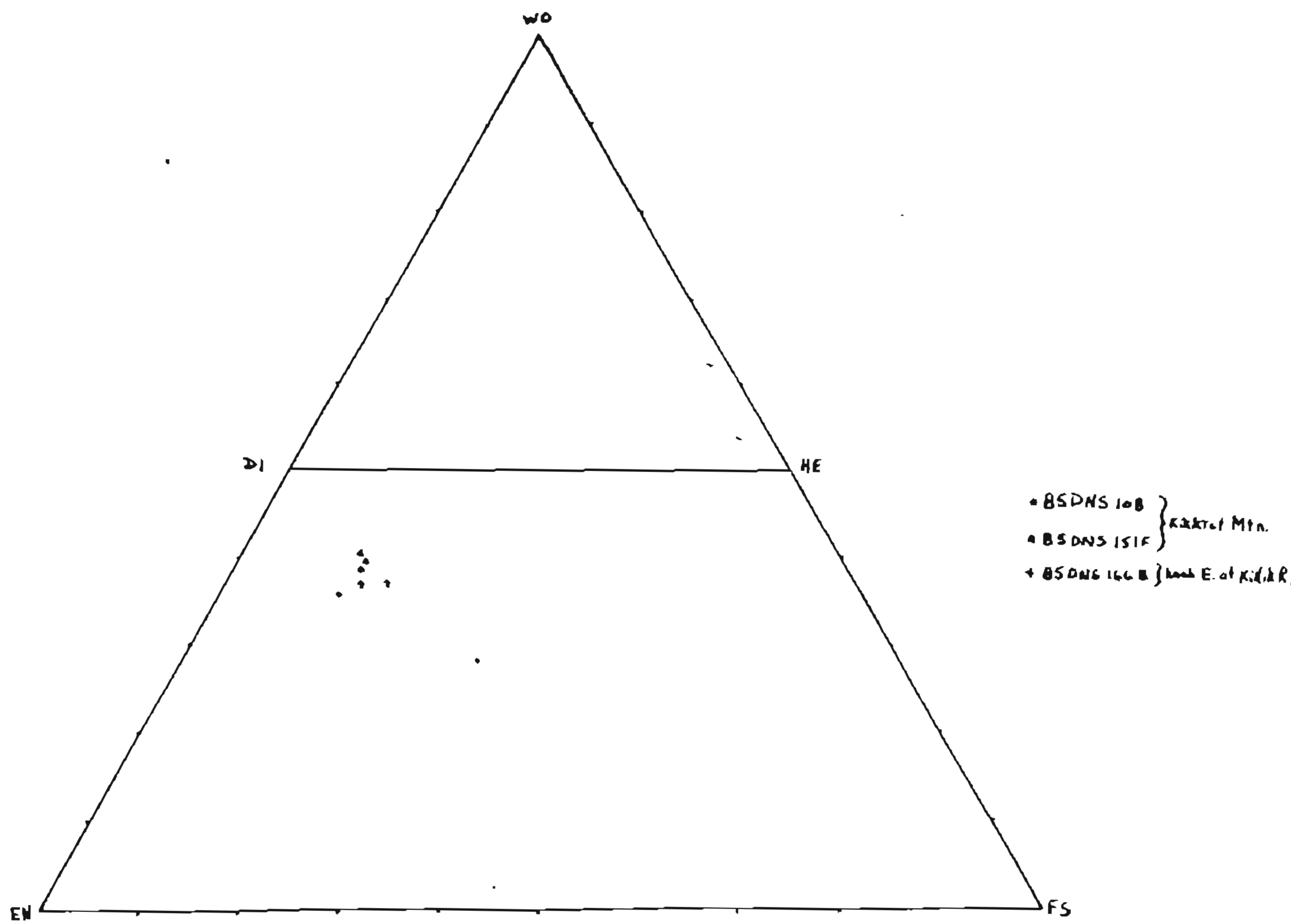

Figure 7. Pyroxene quadrilateral---analyses from Kikiktat Mountain and Killik River basalts.

Table 1. Point counts of 5 Kikiktat basalts and 1 basalt (#166) from east of Killik River. 400 points counted per sample.

POINT COUNTS--KIKIKTAT BASALTS

Sample#	151	108	166	142	119	161
PLAG.	47.25	58.5	49.25	54.25	56.25	52
CPX.	41.75	30.5	38.75	36.75	34	38
OPAQUE	6	4.75	6.5	6.5	3.75	7
OLIVINE?	5	6.25	5.5	2.5	6	3
TOTAL %	100	100	100	100	100	100

Table 2. Major oxide analyses and corresponding CIPW norm calculations for 9 Kikiktat basalts and 2 basalts from east of Killik River (166A and 166B). Total iron was reported as Fe_2O_3, proportioned according to Irvine and Baragar, 1971 such that $Fe_2O_3 = TiO_2 + 1.5$, with rest going to FeO.

	KIKIKTAT										
	105A	107A	119E	122B	123	126D	142	151F	161	166A	166B
SIO2	48.38	48.32	48.45	49.77	48.90	48.97	48.96	50.29	48.52	49.32	49.02
AL2O3	14.84	14.32	14.13	12.83	13.26	14.48	14.49	14.74	13.70	14.33	13.76
FE2O3	3.47	3.24	2.94	3.77	3.11	3.12	3.31	2.96	3.12	3.18	3.45
FEO	9.14	9.28	8.62	10.13	8.26	7.23	8.46	8.13	8.51	9.54	9.02
MGO	6.08	6.61	7.80	5.36	7.74	8.35	6.71	6.93	6.62	7.11	6.87
CAO	10.93	9.76	9.29	10.19	10.84	10.69	10.29	9.15	13.11	7.17	9.72
NA2O	2.47	3.26	3.61	2.52	3.01	2.37	3.04	3.53	1.97	4.36	3.53
K2O	0.19	0.38	0.14	0.24	0.25	0.15	0.19	0.67	0.06	0.17	0.33
TIO2	1.97	1.74	1.44	2.27	1.61	1.62	1.81	1.46	1.62	1.68	1.95
P2O5	0.18	0.16	0.12	0.21	0.13	0.13	0.15	0.13	0.13	0.14	0.17
MNO	0.23	0.23	0.20	0.24	0.20	0.16	0.22	0.25	0.28	0.23	0.24
TOTAL	97.88	97.30	96.74	97.53	97.31	97.27	97.63	98.24	97.56	97.23	98.06
Q	1.518			5.197		0.992			2.134		
OR	1.147	2.308	0.855	1.454	1.518	0.911	1.150	4.030	0.363	1.033	1.989
AB	21.353	28.351	31.576	21.864	26.174	28.617	26.348	30.405	17.086	37.944	30.461
AN	29.469	23.965	22.676	23.569	22.538	29.226	25.945	22.796	29.071	19.570	21.135
WO	10.325	10.323	10.085	11.214	13.300	10.197	10.580	9.414	15.334	6.711	11.235
EN	15.478	11.064	9.522	13.687	15.013	21.379	16.207	12.013	16.900	7.949	11.378
FS	11.332	8.010	5.585	12.494	8.031	8.555	9.912	7.335	11.015	5.631	7.275
FO		4.103	7.399		3.361		0.638	3.893		7.192	4.254
FA		3.274	4.783		1.981		0.430	2.620		5.615	2.998
MT	5.140	4.828	4.406	5.605	4.634	4.651	4.916	4.369	4.637	4.742	5.101
IL	3.822	3.396	2.827	4.420	3.142	3.163	3.521	2.825	3.154	3.282	3.777
AP	0.436	0.389	0.294	0.510	0.316	0.317	0.364	0.313	0.316	0.341	0.411
TOTAL	100.012	100.011	100.009	100.014	100.009	100.009	100.011	100.010	100.009	100.010	100.012
SALIC	53.487	54.623	55.108	52.084	50.230	51.747	53.443	57.232	48.655	58.547	53.585
FEMIC	46.526	45.388	44.901	47.930	49.780	48.262	46.568	42.778	51.354	41.463	46.427
D.I.	24.018	30.658	32.431	28.515	27.692	22.521	27.498	34.435	19.584	38.977	32.449

Table 3. Pyroxene analyses, Kikiktat Mountain basalts, Killik River Quadrangle, Alaska. Electron microprobe, Va. Tech, analyzed by D.N. Solie.

PYROXENE ANALYSES

	85DNS10B	85DNS10B	85DNS10B	85DNS166	85DNS166	85DNS161F	85DNS161F
SIO2	51.23	53.22	52.15	53.37	50.19	51.67	52.12
TIO2	0.98	0.49	0.71	0.59	0 96	0.64	0.51
A2O3	1.75	2.04	3.55	2 34	3.68	3.47	2.52
FEO	18 03	7.61	8 00	8 66	9.68	7.72	7.25
MNO	0.48	0.20	0.24	0.22	0.23	0.22	0 21
MGO	14.72	18 90	17.23	17.76	15.96	16.54	16.67
CAO	13.75	18.00	19.13	18.30	17.53	19.34	20 04
BAO	0.09	0.04	0.04	0.05	0.09	0.0	0.04
NA2O	0.23	0.15	0.22	0.23	0.26	0.24	0.22
K2O	0.02	0.01	0.01	0.01	0.01	0.01	0.01
F	0.01	0.02	0.05	0.07	0.04	0.0	0.06
CL	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	101.28	100.66	101.08	101.53	98.59	99.85	99.59
-O= F+CL	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	101.28	100.66	101.08	101.53	98.59	99.85	99.59

SI	1.927	*	1.936	*	1.900	*	1.933	*	1.887	*	1.906	*	1.926	*
AL	0.073	2.000	0.064	2.000	0.100	2.000	0.067	2.000	0.113	2.000	0.094	2.000	0.074	2.000
AL	0.005	*	0.023	*	0.044	*	0.033	*	0.051	*	0.056	*	0.036	*
TI	0.028	*	0.013	*	0.019	*	0.016	*	0.027	*	0.018	*	0.014	*
FE	0.567	*	0.231	*	0.244	*	0.262	*	0.304	*	0.238	*	0.224	*
MN	0.015	*	0.006	*	0.007	*	0.007	*	0.007	*	0.007	*	0.007	*
MG	0.825	1.441	1.025	1.299	0.936	1.250	0.959	1.277	0.895	1.284	0.909	1.228	0.918	1.199
CA	0.554	*	0.701	*	0.747	*	0.710	*	0.706	*	0.764	*	0.794	*
BA	0.001	*	0.001	*	0.001	*	0.001	*	0.001	*	0.0	*	0.001	*
NA	0.017	*	0.011	*	0.016	*	0.016	*	0.019	*	0.017	*	0.016	*
K	0.001	0.573	0.000	0.713	0 000	0.763	0.000	0.728	0.000	0.727	0.000	0.782	0 000	0.810
O	6.000	*	6.000	*	6.000	*	6.000	*	6.000	*	6.000	*	6.000	*

WO	28.25	35.72	38.62	36.64	36.93	39.84	40.85
EN	42.07	52.18	48.39	49.47	46.77	47.39	47.27
FS	29.69	12.10	12.99	13.88	16.30	12.77	11.87
F/M	0.706	0.232	0.268	0.281	0.348	0.269	0.253
F/FM	0.414	0.188	0.212	0.219	0.258	0.212	0.201

Table 4. Plagioclase analyses, Kikiktat Mountain basalts, Killik River Quadrangle, Alaska. Electron microprobe analyses, analysed by D.N. Solie.

FELDSPAR ANALYSES

	85DNS 109		85DNS 166a		85DNS 166b		85DNS 166b		85DNS 166b	
SIO2	50.71		62.83		68.44		53.36		52.80	
TIO2	0.07		0.08		0.01		0.11		0.13	
A2O3	31.67		24.34		21.12		29.47		29.24	
FEO	0.74		0.53		0.10		1.04		1.03	
MNO	-0.01		-0.01		-0.04		0.0		0.01	
MGO	0.23		0.06		-0.02		0.18		0.19	
CAO	14.82		5.99		1.24		13.04		12.91	
BAO	0.03		-0.01		0.0		-0.03		0.0	
NA2O	3.40		8.58		11.03		4.24		4.18	
K2O	0.03		0.06		0.03		0.06		0.06	
SUM	101.69		102.45		101.91		101.47		100.55	
SI	2.283	*	2.730	*	2.939	*	2.395	*	2.392	*
AL	1.680	*	1.246	*	1.069	*	1.559	*	1.561	*
TI	0.002	3.966	0.003	3.979	0.000	4.008	0.004	3.957	0.004	3.958
FE	0.028	*	0.019	*	0.004	*	0.039	*	0.039	*
MN	-0.000	*	-0.000	*	-0.001	*	0.0	*	0.000	*
MG	0.015	*	0.004	*	-0.001	*	0.012	*	0.013	*
CA	0.715	*	0.279	*	0.057	*	0.627	*	0.627	*
BA	0.001	*	-0.000	*	0.0	*	-0.001	*	0.0	*
NA	0.297	*	0.723	*	0.918	*	0.369	*	0.367	*
K	0.002	1.057	0.003	1.028	0.002	0.978	0.003	1.050	0.003	1.050
O	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*
AN	70.51		27.75,		5.84		62.77		62.84	
AB	29.27		,71.93		93.99		36.94		36.82	
OR	0.17		0.33		0.17		0.34		0.35	
CN	0.05		-0.02		0.0		-0.05		0.0	
F/M	1.780		4.861		0.0		3.242		3.072	
F/FM	0.640		0.829		0.0		0.764		0.754	