HOKKAIDO UNIVERSITY

| | |
|---|---|
| Title | Some Trace-Element Data on Pliocene Basaltic Rocks from Two Districts in Hokkaido |
| Author(s) | Stevens, N.C.; Ōba, Y.; Katsui, Y. |
| Citation | 北海道大学理学部紀要, 18(3), 485-489 |
| Issue Date | 1978-03 |
| Doc URL | https://hdl.handle.net/2115/36667 |
| Type | departmental bulletin paper |
| File Information | 18_3_p485-489.pdf |

Hokkaido University Collection of Scholarly and Academic Papers : HUSCAP

Jour. Fac. Sci., Hokkaido Univ., Ser. IV,
vol. 18, no. 3, Mar., 1978, pp. 485-489.

# SOME TRACE-ELEMENT DATA ON PLIOCENE BASALTIC ROCKS FROM TWO DISTRICTS IN HOKKAIDO

*by*

N.C. Stevens*, Y. Ōba** and Y. Katsui

(with 1 table and 1 text-figure)

(Contribution from the Department of Geology and Mineralogy,
Faculty of Science, Hokkaido University, No. 1549)

*Abstract*

Trace elements Rb, Sr, Zr, Y, Cu, Ni, Zn, Co, and Pb are recorded from basaltic rocks of the Kitami-Monbetsu district of east Hokkaido and the Takikawa-Fukagawa Basin and Kabato Mountains of central-west Hokkaido. Those of the former district, although petrologically similar to some from the latter district, show a different distribution of trace elements. In particular Zr and Zn are higher, and Rb and Sr are lower in the eastern basalts. Other slight differences are suggested. The reason may be an initial abundance variation.

## Introduction

Pliocene basaltic rocks from two areas in Hokkaido (Kabato Mountains and Takikawa-Fukagawa basin to the north and northeast of Sapporo, and the Kitami-Monbetsu district fronting the Okhotsk Sea in northeast Hokkaido) have been studied by Ōba (1968, 1971, 1972, 1975), who presented 30 major-element analyses. Eleven of these rocks have been analysed for trace-elements Rb, Sr, Zr, Y, Cu, Ni, Zn, Co and Pb in theX-ray laboratory of the Department of Geology and Mineralogy, University of Queensland, Brisbane, by A.S. Bagley using a Philips PW1410 X-ray spectrometer. Checks were made against standards BCR-1, G-2, AGV-1 and GSP-1.

Eight of the analysed rocks come from the more westerly occurrence; they comprise four "Basin type basalts" (Ōba, 1972) from the Takikawa-Fukagawa basin (W1, W2, W4, W6) and two each from the Hamamasu (W7, W12) and Etai-dake (W14, W18) basalt complexes of the Kabato Mountains. These range from porphyritic olivine basalt (W1, W7) through basalts with phenocrysts of olivine and augite (W2, W4, W6, W14) to olivine-bearing basaltic andesites (W12, W18). The Basin type basalts are high in $Al_2O_3$, but are classified as

* Department of Geology and Mineralogy, University of Queensland
** Department of Earth Science, Faculty of Science, Yamagata University

primitive alkali olivine basalts; those of Hamamasu and Etai-dake are in the high-alumina basalt field or close to its boundary with the alkali basalt field. The remaining three basalts from northeast Hokkaido are olivine basalts, and have been plotted in much the same field as those from Hamamasu and Etai-dake, except that some of the more basic rocks have less alkalies.

## Discussion of Results

From the limited number of analyses carried out (Table 1), the following suggestions are made:

1. Zr is higher and Sr lower in the Kitami-Monbetsu (eastern) basalts.
2. Rb is lower and Zn slightly higher in the eastern basalts and W1, compared with the remainder.
3. Cu is slightly lower in the eastern basalts.
4. Y is slightly higher in the eastern basalts and W18.
5. Pb is lower in the Kabato Mountains basalts (especially in the two Hamamasu samples) except for an anomalously low Basin type basalt (W2).
6. Ni is variable, and at least in the western basalts is correlated with the percentage of olivine phenocrysts.
7. Co is fairly uniform, but appears to be slightly lower in the basaltic andesites (increasing $SiO_2$).

**Table 1** Trace-element data in ppm.

| Sample | Rb | Sr | Zr | Y | Cu | Ni | Zn | Co | Pb | K/Rb |
|---|---|---|---|---|---|---|---|---|---|---|
| E1 | 15 | 369 | 156 | 36 | 36 | 113 | 81 | 30 | 2 | 321 |
| E4 | 11 | 366 | 145 | 32 | 27 | 71 | 102 | 29 | 3.1 | 498 |
| E7 | 18 | 374 | 160 | 30 | 33 | 114 | 82 | 25 | 2.2 | 332 |
| W1 | 16 | 415 | 88 | 23 | 58 | 187 | 82 | 34 | 2.3 | 400 |
| W2 | 44 | 665 | 110 | 27 | 54 | 42 | 73 | 24 | >0.1 | 232 |
| W4 | 22 | 460 | 82 | 26 | 40 | 87 | 67 | 26 | 2.7 | 260 |
| W6 | 23 | 488 | 87 | 26 | 39 | 71 | 67 | 25 | 2.3 | 303 |
| W7 | 44 | 510 | 81 | 23 | 61 | 79 | 74 | 26 | 0.6 | 240 |
| W12 | 51 | 579 | 105 | 22 | 42 | 69 | 60 | 22 | 0.3 | 231 |
| W14 | 36 | 509 | 92 | 27 | 46 | 125 | 67 | 28 | 1.0 | 224 |
| W18 | 62 | 432 | 113 | 33 | 55 | 110 | 54 | 23 | 1.8 | 200 |
| mE | 15 | 370 | 154 | 33 | 32 | 99 | 88 | 28 | 2.4 | 384 |
| mW | 37 | 507 | 95 | 26 | 49 | 96 | 68 | 26 | 1.4 | 261 |

Pb results as calculated (precision less than results infer).
E = Kitami-Monbetsu district (Ōba, 1975, Table 2): W = Western Hokkaido (Ōba, 1972, Table 2): mE, mW = mean of E and W rocks respectively.
See text for districts and names of rocks.

The main trace-element differences are between the eastern (Kitami-Monbetsu) and western (Basin type and Kabato Mountains) basalts as indicated by the mean values in Table 1. The eastern basalts however are not distinctive,

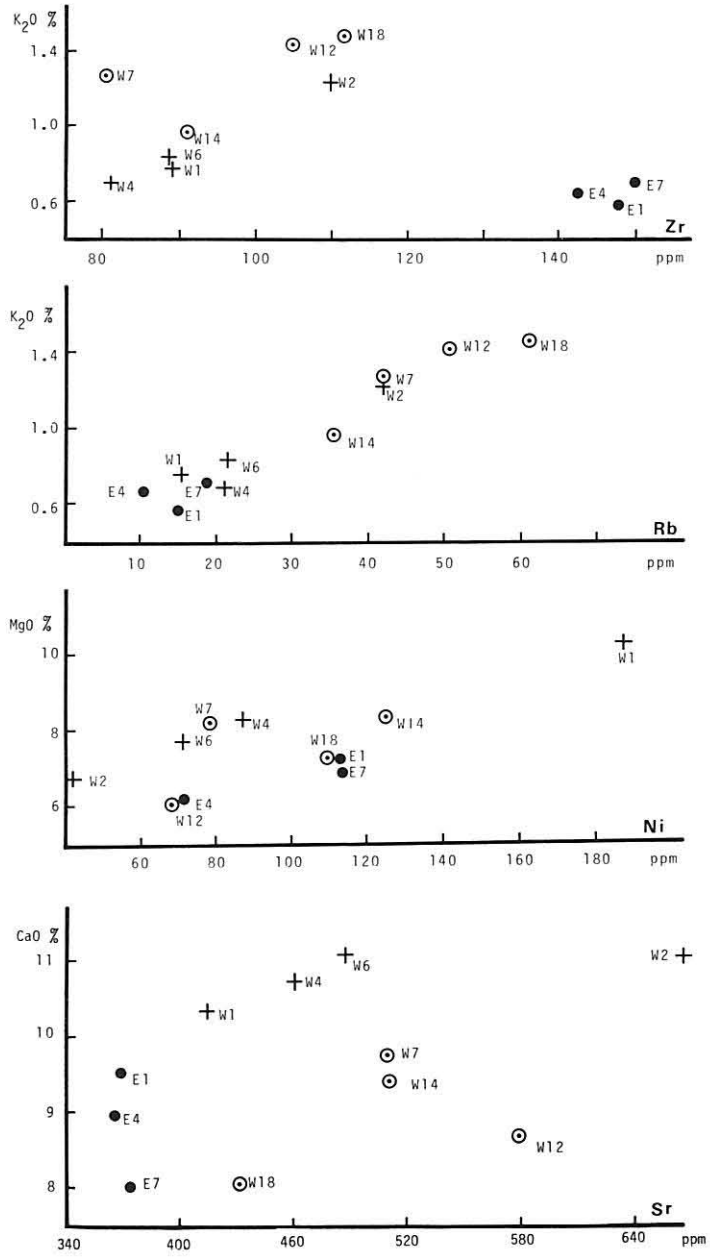


**Fig. 1** Zr and Rb v. $K_2O$, Ni v. MgO, and Sr v. CaO.

petrologically or mineralogically, from the western basalts; they have similar petrographic features to those of the Kabato Mountains and both these groups are plotted mainly in the field of high-alumina basalts (Ōba, 1975). The three eastern basalts chosen for trace-element analysis lie on either side of the join line between the fields of alkali basalts and high alumina basalts (Kuno, 1968) and have total alkalies comparable with the Basin type basalts. The eastern basalts are also slightly lower in alumina than the western basalts, and the analysed samples E1, E4 and E7 are slightly higher in soda and lower in potash.

The more alkaline olivine basalts in these districts are the Basin type basalts, which should have more Rb, Sr and Zr than tholeiites, but less Cu and Y (Prinz, 1967, p.318). These relations should also hold between alkali basalts and high-alumina basalts, but although the Basin type basalts have more Rb and Sr and less Y than the eastern basalts, they have less Zr and more Cu. Differences between trace-elements of Basin type and Kabato Mountains basalts are less obvious and some have already been noted in the summary above.

Correlations of trace with major elements Na, K. etc. have been noticed, e.g. K – Rb, MgO – Ni and (in the western basalts) Zr – K and Zr – Total alkalies (Fig. 1), but not Ca – Sr. In the K/Zr ratio, the eastern basalts are distinctive (mean 35), compared with Basin type basalts (79) and Kabato Mountains basalts (110). There is also a positive correlation between Rb and K content, with K/Rb ratios higher in the eastern basalts and W1, and lowest in the most differentiated western basalts.

*Acknowledgement*

This short paper is dedicated to Professor Kenzo Yagi at his retirement from Hokkaido University.

We are grateful to Professor A. Ewart of University of Queensland for a critical reading of the manuscript. The trace-element analysis was carried out by Mr. A.S. Bagley of the same university, to whom our thanks are due.

*References*

Kuno, H., 1968. Differentiation of basalt magmas. In: H.H. Hess and A. Poldervaart (Editors), *Basalt, The Poldervaart Treatise on Rocks of Basaltic Composition,* Interscience, New York, vol.2, pp.623-688.

Ōba, Y., 1968. Petrological study of the Neogene basalts from the western part of Hokkaido, (1) The basin type basalts of Takikawa-Fukagawa district. *J. Japan. Ass. Min. Petr. Econ. Geol.,* 60: 222-227. (in Japanese with English abstract)

Ōba, Y., 1971. Petrological study of the Neogene basalts from the western part of Hokkaido, (2) Petrology of the Etai-dake basalts. *J. Japan. Ass. Min. Petr. Econ. Geol.*, 66: 190-196. (in Japanese with English abstract)

Ōba, Y., 1972. Petrology of the late Pliocene basalts of the western part of Hokkaido. *J. Fac. Sci., Hokkaido Univ., Ser.4*, 15: 11-26.

Ōba, Y., 1975. Late Neogene basaltic rocks from the Kitami-Monbetsu district, northeast Hokkaido. *J. Fac. Sci., Hokkaido Univ., Ser.4*, 16: 501-510.

Prinz, M., 1967. Geochemistry of basaltic rocks: Trace elements. In: H.H. Hess and A. Poldervaart (Editors), *Basalt, The Poldervaart Treatise on Rocks of Basaltic Composition*, Interscience, New York, vol.1, pp.271-323.

(Received on Oct. 31, 1977)