A COMPUTER PROGRAM FOR THE DETERMINATION OF MOLECULAR NORMS FOR THE FINE-GRAINED AND ALTERED ROCKS OF THE BOB CREEK AREA (93L/7)

By B. N. Church

The determination of normative mineral compositions from major oxide analyses offers a method of comparison of coarse or medium-grained igneous rocks with fine-grained or altered equivalents. To this end, Barth (1952, pp. 76-82) described the necessary simplified calculations following the 'Niggli procedure,' whereby oxide weights for each rock are transformed to equivalent molecular units. The resulting 'molecular norm' is considered to be simpler and a better approximation of modal mineralogy than the traditional CIPW 'weight norm' (Wahlstrom, 1955, pp. 82-85).

In Table 18-1 a computer program to assist in study of the igneous rocks of the Bob Creek prospect (*see* accompanying report), and fine-grained effusives in general. This program is specifically for the TI 99-4/A computer, however, with some slight modifications it is readily adaptable to any microcomputer with Basic language facility.

Weight per cent for the nine most important oxides in igneous rocks, including TiO_2, FeO, and Fe_2O_3, are input into the program. Output is molecular percentage for as many as 14 of the most common anhydrous and non-carbonate end member minerals, including olivine and nepheline for silica deficient samples.

The method is demonstrated using Chayes' (1975) average compositions (Table 18-2) and four analyses from the Bob Creek area. Negative normative quartz indicates undersaturation in silica. This negative value causes conversion of some or all of enstatite and ferrosilite to forsterite and fayalite. Additional undersaturation results in conversion of albite to nepheline. (There is no provision for leucite in this program). Small negative values for magnetite can usually be ignored as this simply indicates that ferrous iron is less than titanium, which is sometimes the case in oxidized and altered rocks.

REFERENCES

Barth, T.F.W. (1952): Theoretical Petrology, *J. Wiley & Sons*, New York, 117 pp.

Chayes, F. (1975): Statistical Petrology, *in* Annual Report of the Director Geophysical Laboratory, *Carnegie Institution*, Washington, D.C., pp. 542-550.

Wahlstrom, E. E. (1955): Petrographic Mineralogy, *J. Wiley & Sons*, New York, 408 pp.

TABLE 18-2
AVERAGE COMPOSITIONS OF COMMON VOLCANIC ROCKS
(Chayes, 1975)

	1	2	3	4	5	6
SiO_2	71.56	65.33	58.19	58.28	56.70	45.56
TiO_2	0.32	0.62	0.82	0.86	0.84	2.55
Al_2O_3	13.58	15.58	17.22	18.28	19.06	14.61
Fe_2O_3	1.58	2.37	3.09	2.93	2.71	4.27
FeO	1.10	2.33	4.05	2.00	1.70	7.38
MnO	0.07	0.12	0.15	0.19	0.21	0.18
MgO	0.47	1.62	3.22	1.20	1.04	8.45
CaO	1.41	4.31	6.81	3.05	2.62	10.23
Na_2O	3.80	3.72	3.29	6.63	7.55	3.20
K_2O	4.19	2.27	1.68	4.82	5.17	1.40
P_2O_5	0.12	0.18	0.23	0.25	0.22	0.59
H_2O	1.96	1.54	1.33	1.47	1.99	1.56
Molecular Norms:						
Qz	28.3	22.1	12.4	—	—	—
Or	25.5	13.8	10.2	28.3	30.3	3.5
Ne	—	—	—	5.6	15.3	2.2
Ab	35.0	34.4	30.2	49.9	41.7	25.6
An	7.2	19.6	27.9	5.9	2.8	21.8
Wo	—	1.0	2.7	3.7	4.0	12.0
Eu	1.3	4.6	9.1	—	—	—
Fs	0.2	1.1	3.0	—	—	—
Fo	—	—	—	2.5	2.1	17.9
Fa	—	—	—	—	—	3.8
Il	0.5	0.9	1.2	1.2	1.2	3.6
Mt	1.7	2.5	3.3	2.8	2.2	4.6
He	—	—	—	0.1	0.4	—
Cr	0.3	—	—	—	—	—

Key to Analyses:

1 — Rhyolite, 2 — Dacite, 3 — Andesite, 4 — Trachyte, 5 — Phonolite, 6 — Basalt

British Columbia Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork, 1985, Paper 1986-1.

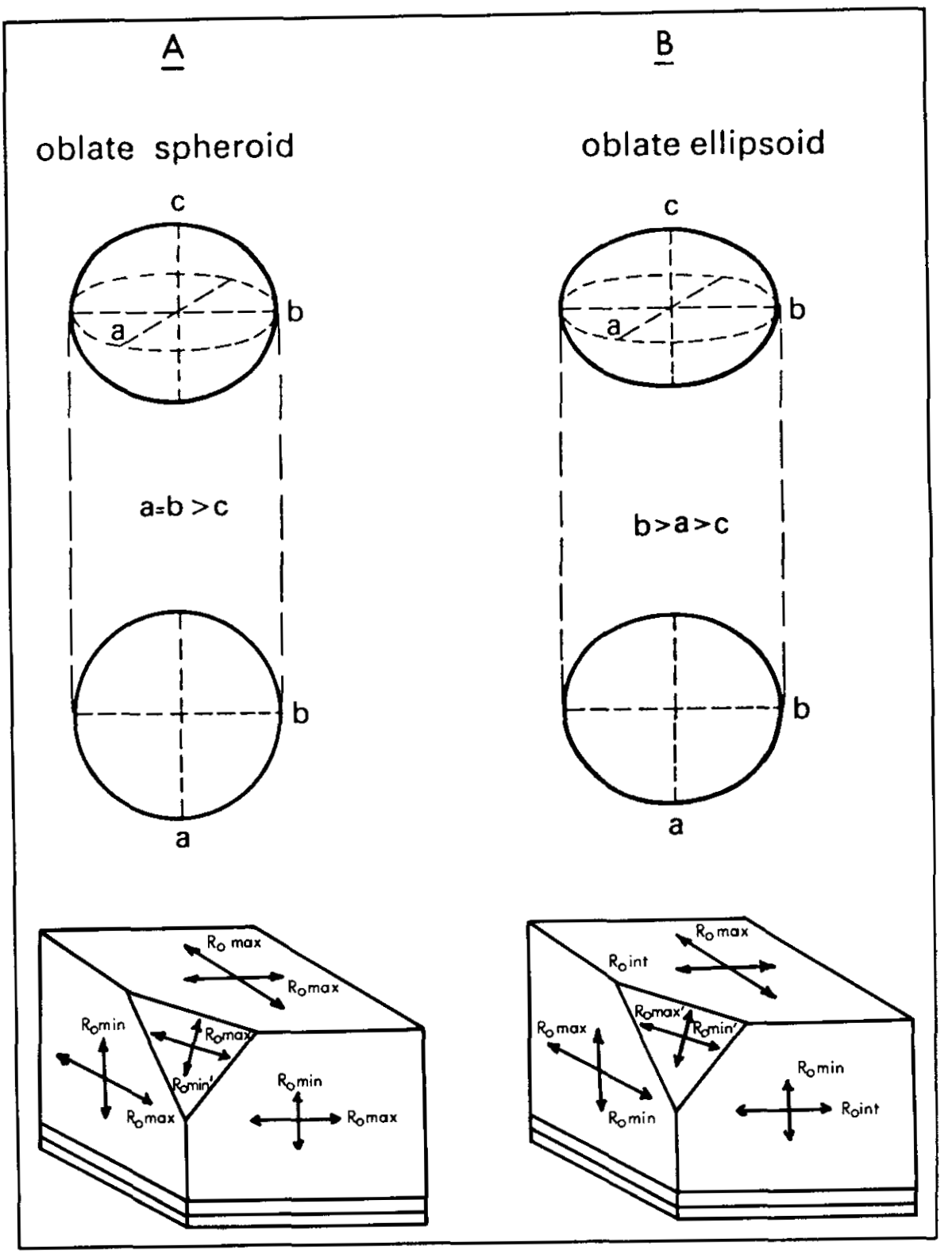

Figure 19-1. Reflectance indicatrix shapes and corresponding reflectance readings which may be obtained from a block of coal for uniaxial (a) and biaxial (b) coals.