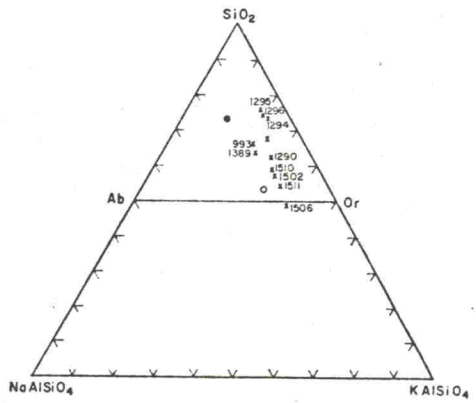

Fig. 2. Projection of chemical analyses of altered breccias from the Brent crater into the system SiO_2-$NaAlSiO_4$-$KAlSiO_4$. Crosses show the position of each of the 11 individual analyses averaged in Table 2, with the identification number of each analysis. The solid circle shows the average composition of the country rocks; the open circle shows average composition of the potassic trachyte. Note the strong linear trend of the analyses away from the SiO_2 corner toward the average composition of potassic trachyte.

TABLE 3. Chemical Composition of Country Rocks and Igneous Rocks from the Mistastin Lake Crater

	1 wt %	2 wt %	3 wt %	4 wt %	5 wt %	6 wt %	7 wt %
SiO_2	68.3	52.0	60.9	65.5	55.9	56.6	56.9
TiO_2	0.52	0.42	1.34	0.59	0.97	1.20	0.80
Al_2O_3	14.5	27.2	14.5	15.8	19.5	17.8	20.9
Fe_2O_3	7.1	1.0	4.3	1.3	4.1	7.3	2.3
FeO	2.5	2.6	5.6	2.9	2.2	0.4	3.9
MgO	0.6	1.5	0.9	0.8	1.7	1.7	1.2
CaO	1.9	8.9	4.5	3.0	6.5	5.7	6.5
MnO	0.05	0.04	0.12	0.05	0.08	0.09	0.07
Na_2O	4.0	5.3	4.0	4.1	4.6	4.2	4.6
K_2O	5.7	0.9	4.2	5.0	2.0	1.3	2.7
H_2O	0.4	0.6	1.2	0.6	1.2	1.8	0.8
P_2O_5	0.15	0.16	0.34	0.17	0.31	0.33	0.23
Rb (ppm)	162	0	63	131	20	nil	41

1. Average augen granodiorite (4 analyses).
2. Average anorthosite (3 analyses).
3. Average mangerite (3 analyses).
4. Estimated average Precambrian rock in crater (77% analysis 1 + 12% analysis 2 + 11% analysis 3; 10 analyses).
5. Average massive igneous rock (6 analyses).
6. Average igneous breccia (4 analyses).
7. Mix of Precambrian rocks closest in composition to igneous rocks (9% analysis 1 + 51% analysis 2 + 40% analysis 3).

TABLE 4. Chemical Composition of Country Rocks and Igneous Rocks from the Clearwater Lake Craters

	1 wt %	2 wt %	2 s.d.	3 wt %	3 s.d.	4 wt %	4 s.d.	5 wt %	6 wt %	7 wt %	7 s.d.	8 wt %
SiO_2	63.2	60.84	6.95	65.3	7.61	62.8	1.54	63.5	57.2	60.37	1.88	38.7
TiO_2	0.51	0.71	0.41	0.43	0.39	0.50	0.01	0.89	0.89	0.73	0.13	0.54
Al_2O_3	15.6	16.68	1.19	17.4	2.32	15.8	1.37	21.0	16.2	15.90	0.58	11.9
Fe_2O_3	2.0	1.99	1.01	2.1	1.76	2.7	0.54	3.1	5.1	4.12	1.23	4.3
FeO	2.8	3.26	1.57	2.6	1.58	1.9	0.55	1.9	0.9	1.18	0.80	2.7
MgO	3.1	2.38	1.85	1.5	1.34	2.9	0.65	1.5	2.9	2.67	0.57	15.7
CaO	3.3	4.82	1.69	3.0	1.95	3.8	0.61	2.1	4.6	4.48	0.51	3.2
MnO	0.08	0.09	0.08	0.04	—	0.10	0.03	0.14	0.05	0.05	0.01	0.12
Na_2O	3.8	4.31	0.53	3.38	1.04	3.05	0.31	1.65	3.91	3.78	0.40	1.12
K_2O	3.1	2.38	0.82	3.36	0.83	3.69	0.14	6.40	3.41	3.60	0.45	0.11
H_2O	0.9	0.76	0.27	0.41	0.31	2.30	0.75	4.21	2.06	1.33	0.87	10.9
P_2O_5	0.21	0.25	0.18	0.27	0.07	0.32	0.04	0.41	0.30	0.30	0.08	0.3
Selected Trace-Element Data (in ppm)												
Zn		25		50		235		40	75	205		70
Cu		10		20		30		3	20	67		19
Ni		35		12		780		90	20	5		20
Co		30		5		35		7	50	30		30
Cr		10		20		200		10	5	5		5
V		120		65		65		70	180	110		100
Ba		850		770		550		2000	720	1000		1020
Zr		95		130		150		300				

1. Average country rock, from *Eade et al.* [1966].
2. Average country rock, from *Bostock* [1969] (16 analyses).
3. Average country rock, central uplift of east lake (20 analyses).
4. Average massive igneous rock from east lake (12 analyses).
5. Average igneous breccia, east lake (6 analyses).
6. Average igneous breccia, west lake (8 analyses).
7. Average massive igneous rock from west lake (12 analyses).
8. Average analysis of gypsiferous ultramafic veinlets from drill cores beneath west lake (4 analyses).

breccia penetrated in bore holes, including gypsiferous serpentine seams. Although not analyzed, mineralization in the form of millerite-tetrahedrite seams is also found in these cores. The chemical results show significant enrichment of potassium and impoverishment in soda in igneous rocks relative to country rocks. The igneous rocks in West Clearwater Lake crater are enriched in alkalies and impoverished in magnesium, nickel, and chromium compared with those in East Clearwater Lake crater, which, according to conventional petrologic theory, would indicate a somewhat higher degree of differentiation.

Carswell crater forms an almost perfect circle 39 km in diameter, cut through Proterozoic sandstone into crystalline rocks [*Currie*, 1969c]. A rim syncline overturned away from the center is bounded on both sides by faults. The central core of crystalline rocks, shock metamorphosed along its margin, is separated from the rim sandstone by lenses of aphanitic, flow-banded, fragment-charged rocks, sheathed by igneous breccia. These igneous rocks are significantly richer in potassium and magnesium, and poorer in silicon and sodium than the crystalline rocks. If the sedimentary rocks are included, the differences are even larger. Shock metamorphism is not found in the sedimentary rocks, even where they overlie shock-metamorphosed basement rocks [*Currie*, 1967].

The *Sudbury structure*, 58 km long by 22 km wide, poses some of the difficult problems in Canadian geology. The geology is highly complex and controversial, and chemical data are not particularly abundant. The Sudbury irruptive has the form of a lopolithic sheet, 1.72 b.y. old, whose mean composition (Table 1) as computed by *Collins* [1934] is somewhat similar to that of igneous rocks found in other Canadian craters, but rather different from that of large gabbroic lopoliths. The irruptive is overlain