The ranking used by Parsons and Boyd may be criticized on the grounds of crudity and the fact that diffuseness of reflections in perthitic crystals could be caused by compositional variation in the K-phases or lattice distortion at interfaces between K and Na-phases, rather than by variation in degree of order. However, the specimens do not give significantly anomalous 060–$\bar{2}04$ 2θ values, $\bar{2}01$ reflections are sharp, and the ranking by Wright's method seems to confirm the assumption that the 131 reflection types show the relative proportion of highly ordered K-feldspar, close to maximum microcline, and less well ordered material, 'orthoclase', in the samples. Fig. 1 should not, of course, be interpreted in a strictly quantitative fashion. Whether the distinct separate grouping of the types 1 and 2a reflections is due to differing degrees of order in the monoclinic feldspar or skewing of $\bar{2}04$ and 060 by the small amount of more ordered triclinic material present in type 2a is not clear although it does appear to support the correctness of the distinction drawn by Parsons and Boyd.

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Carbon-dioxide metasomatism in the Campsie Lavas

IN the Campsie Fells, north of Glasgow, basalts and related volcanic rocks of the Clyde Plateau Lavas (Lower Carboniferous) exhibit varying degrees of alteration, there being few flows that can be described as completely fresh. Alteration usually takes the form of a break-down of ferro-magnesium minerals, which in many cases are replaced by calcite. This calcitization is commonly accompanied by oxidation, which in extreme cases converts nearly all the iron to the ferric state.

The above features are characteristic throughout the Campsie Fells except in an area about 1½ miles across lying between the Meikle Bin volcanic vent and the plug, Dungoil (Geological Survey Scotland, 1″ sheet 31). Within this area calcitization is more intense than usual; there are areas of near-complete alteration where the lavas have been transformed to a cream-coloured rock, which often contains small amounts

of finely divided pyrite and occasional galena. In some localities unweathered specimens of the altered rock contain small phenocrysts with a habit resembling that of plagioclase.

In a thin section of a specimen from Bin Burn (NS 657828) on the west side of Meikle Bin, the fine-grained groundmass consists of a patchy intergrowth of secondary quartz and carbonate minerals. In places individual quartz grains form a fine-grained interlocking mosaic. Euhedral ore grains, up to about 0·1 mm across, are replaced by leucoxene. Apatite, although present only in small amounts, stands out from the groundmass because of its freshness. The phenocrysts have been almost completely replaced by quartz and calcite but their elongate habit and occasional vestiges of albite twinning show that they were composed of plagioclase.

TABLE I. *Chemical analysis and C.I.P.W. norm (calculated in terms of carbonate minerals) of altered lava (R9652 in the Hunterian Museum Catalogue, University of Glasgow). Analyst J. G. MacDonald*

SiO_2	56·98	CaO	3·15	quartz	38·64	magnetite	1·16
TiO_2	0·79	Na_2O	1·43	orthoclase	15·57	ilmenite	1·52
Al_2O_3	13·10	K_2O	2·65	albite	12·05	apatite	0·67
Fe_2O_3	0·78	P_2O_5	0·26	corundum	7·85	CO_2 (surplus)	0·09
FeO	8·02	H_2O^+	2·71	magnesite	3·61	H_2O	2·71
MnO	0·17	CO_2	8·48	siderite	11·37		
MgO	1·70	Sum	100·22	calcite	5·00	Sum	100·24

Features of the chemical composition (table I) are the high SiO_2 and CO_2 percentages and the low Fe_2O_3/FeO and Na_2O/K_2O ratios. In the norm all the ferrous iron, apart from that incorporated in magnetite, is required along with all the manganese, magnesium, and calcium, for carbonate minerals. In this way the CO_2 available is almost completely allocated, the small surplus being accountable to experimental error.

The relative proportions of carbonates in the norm suggest that about half is in the form of ankerite, the rest consisting of siderite. Free calcite is confined mainly to the occasional altered phenocryst. Oxidation of samples from Bin Burn and Clachie Burn (NS 637838) in a muffle furnace for one hour at 550 °C resulted in darkening in colour and a sharp increase in magnetic susceptibility, again suggesting the presence of ankerite (Deer, Howie, and Zussman, 1963, **5**, 298).

The fine grain size of the rocks makes it difficult to obtain even a partial separation of the constituents of the groundmass, but X-ray diffraction data obtained from a powdered whole-rock sample indicate that the major constituents are quartz and siderite with other carbonates (possibly ankerite) and smaller amounts of feldspar. The chemical analysis, with its excessive normative corundum, suggests that other minerals are present. These may be associated with unidentified peaks in the diffraction data.

The altered rocks in their chemical composition and mineralogy are unlike any common igneous or sedimentary rocks but could be a product of intense carbon-dioxide metasomatism of basic or intermediate lava. The alteration is not unlike that found in association with the Mother Lode of California (Knopf, 1929), but there is

a lack of sericite in the specimens examined. Also there is no obvious depletion in silica.

The area occupied by the altered rocks is centred in a depressed tract of ground, largely devoid of outcrops, considered by Geikie (Macgregor *et al.*, 1925, 147) to conceal a volcanic vent, possibly an extension of the Meikle Bin vent. The strata underlying the lavas in this area include the Cementstone Group, which includes many beds of dolomitic limestone. The alteration could have resulted from the circulation of heated ground water resulting from intrusion of magma associated with Lower Carboniferous volcanicity in the Campsies.

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Lawsonite pseudomorphed in Tauern greenschist

PSEUDOMORPHS after porphyroblasts of lawsonite have been found in greenschists within the Tauern window of the Austrian Alps. These rocks occur in the Pennine Mesozoic series, which has undergone metamorphism of Alpine age only. This is evidence that the greenschist facies was preceded by an earlier phase of Alpine metamorphism at higher pressure and low temperature.

The pseudomorphs were found on the northern side of Virgental, Ost-Tirol (47° 02′ N, 12° 19′ E), near the head of the River Isel. This locality is near the southern edge of the Obereschieferhülle—the Mesozoic series, equivalent to the Bündnerschiefer of Switzerland, which is exposed within the structural window and sheathes the older core of the Hohe Tauern.