Meanwhile the palæontological evidence proves a Cambrian age and is strongly suggestive that it is Middle Cambrian. This being so the Newgale Beds, as Jones stated, must be equated with the Solva Series, the Menevian Series of the Middle Cambrian being a most improbable equivalent because of its lithology.

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H. G. DAVIES
C. DOWNIE

Department of Geology,
University of Sheffield.

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Coal Ranks and Geothermal Gradients in High-volatile Bituminous Coalfields

FORTY samples of coal from oil-prospecting wells drilled by Shell BP Todd Oil Services, Ltd., in the Taranaki area of New Zealand have been analysed at the Chemistry Division of the New Zealand Department of Scientific and Industrial Research. Full analytical details and a discussion of the depth/rank relation are given by us[1], and we emphasize that direct comparison of the analyses is not satisfactory because the coal types and sulphur contents vary widely. It was necessary to make some allowance for these variations, the method used being that of Suggate[2]. Within the high-volatile bituminous range of rank penetrated in the wells, the most satisfactory parameter of rank is the calorific value.

All four wells penetrated coals ranging through stratigraphic intervals of between 2,100 and 2,500 ft., the deepest coals being from depths ranging between 12,900 and 14,700 ft. The coal measures are of Upper Eocene or Lower Oligocene age[3], and above them sediments from Oligocene to early Pleistocene in age were deposited without major breaks in sedimentation. Slight uplift and erosion followed, and for some wells it has been found possible to make reasonable estimates of the thicknesses eroded, and consequently of the original depths of burial. From a composite column over the 12,000–17,000 ft. range of depth of burial, an increase of 280 B.T.U./lb. per 1,000 ft. increase of depth is estimated; individual well sequences, based on comparatively few analyses, tend to show rather lower rates of increase of calorific value with depth.

The proximate analysis (air-dried basis) of the most deeply buried coal is as follows: M., 1·2 per cent; V.M., 44·1 per cent; F.C., 48·4 per cent; A., 6·3 per cent; S., 1·2 per cent; B.T.U./lb., 14,380; Sw. No., 6½. If it is assumed that no great changes in geothermal gradient have occurred since the early Pleistocene, this coal was metamorphosed at a temperature of 280°–300° F., judged by temperature measurements in the wells.

The rate of increase of calorific value with increasing depth is only a little more than half the 500 B.T.U./lb / 1,000 ft. found in Carboniferous coals in the Pie Rough Bore in England[4] and in bores in the Saar and Upper Silesia[5]. The most obvious explanation is that of a nearly two to one difference in geothermal gradient. Comparison of data from the Carboniferous coalfields of the Netherlands with analyses of single samples of Jurassic coal from Mississippi at a depth of 16,193 ft. and of Eocene coal from Venezuela at a depth of 11,200 ft. has already led Kuyl and Patijn[6] to suggest that the geothermal gradient in the Carboniferous was much greater than in Mesozoic and Tertiary times. The present geothermal gradient in the Taranaki coal measures is about 19° F./1,000 ft., and if that in the European Carboniferous were greater in proportion to the difference between the rank gradients, it would have been about 34° F./1,000 ft. Such a high gradient, however, is greater than that now found at depth almost anywhere except in hydrothermal areas. Before this gradient is accepted for the Carboniferous, the effects of possible lower pressure should be considered[7], if depth of burial was less and the temperature gradient only moderately higher.

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R. P. SUGGATE
N.Z. Geological Survey,

J. O. ELPHICK
Chemistry Division,
Department of Scientific and Industrial Research,
Wellington, New Zealand.

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CRYSTALLOGRAPHY

Production of Dislocation Etch Pits on Calcite using Optically Active Etchants

SEVERAL etchants, usually consisting of aqueous solutions of organic acids, have been shown[1–5] to produce etch pits at the points of emergence of dislocations on the rhombohedral cleavage faces of calcite crystals. Moreover, if the pits are particularly well defined it is often possible to deduce, from their internal structure, the plane and the direction in which the dislocation line runs through the crystal, a possibility of considerable interest to us since we are endeavouring to assess the role of line imperfections in the chemical reactivity of calcite.

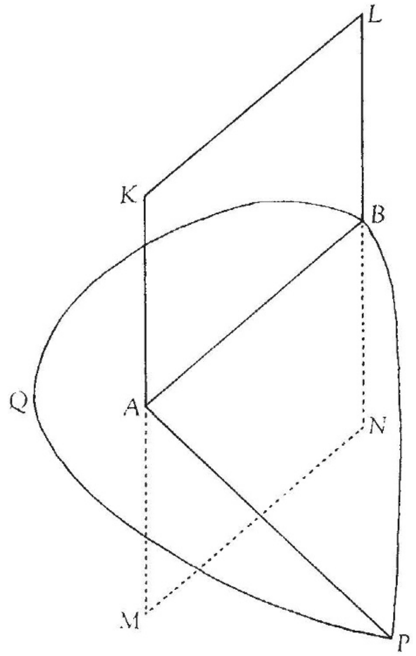

Fig. 1. Schematic representation of etch-pit produced by D- and L-tartaric acids showing plane in which the dislocations lie. Dotted lines indicate the section of the plane below the plane of the paper