

will contain no alumina in its non-clay fraction. On the other hand, a soil in the early stages of chemical weathering will contain considerable amounts of alumina as unweathered aluminosilicates in the non-clay fraction. We therefore propose, as a measure of the degree of weathering, the amount of alumina in the clay fraction, calculated as a percentage of the total alumina of the soil. For example, if a certain soil contains 20.5 per cent of alumina, of which 16.4 per cent is in the clay fraction, the degree of weathering is 80 per cent. A parallel estimate may be obtained from the percentage of the total ferric oxide of the soil present in the clay fraction, but in many cases, particularly in tropical soils, there are considerable proportions of secondary ferric oxide in the non-clay fraction. Indeed, with lateritic soils, the partition of alumina is equally untrustworthy as a measure of the degree of weathering.

We have divided the soils examined by this method into two categories, namely, (1) soils derived by primary weathering from crystalline rocks, and (2) soils derived from materials such as alluvium and marine sediments which have already undergone one or more cycles of weathering. In Category 1, we may distinguish (a) soils such as those in Britain, in which chemical weathering has only proceeded to a moderate extent, and (b) soils of the humid tropics, in which chemical weathering is far advanced.

We have examined five soils in Category 1 (a), six soils in Category 1 (b), and seven soils in Category 2. Our results are shown in the following table, which gives the average degree of weathering calculated from the alumina and from the ferric oxide data respectively.

	Degree of Weathering calculated from	
	Al ₂ O ₃	Fe ₂ O ₃
Category 1 (a) . . .	33.0 (18.6-40.3)	32.1 (15.5-43.1)
Category 1 (b) . . .	76.5 (58.4-89.7)	66.1 (58.6-94.3)
Category 2 . . .	82.9 (70.5-93.4)	64.5 (48.5-84.3)

It will be seen that the figures obtained are in good agreement with expectation, for the tropical soils and the soils of secondary origin show much higher degrees of weathering than the relatively immature soils derived by primary weathering under British conditions. The degrees of weathering calculated from the ferric oxide data are in the same order as those calculated from the alumina, but are rather lower, partly on account of the presence of ferric oxide of secondary origin in the non-clay fraction, and partly on account of the presence, in some cases, of unweatherable minerals of the magnetite group.

Though only approximate in character, the proposed method may serve as a simple procedure for obtaining an estimate of the relative maturity of soils, and may, therefore, aid in the sub-classification of the major soil groups. It may also find an application in the study of regolithic materials.

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Function of the Spiracles of Insects

In carrying out investigations on the respiration of insects, with particular reference to the action of the spiracles and the factors which control their activity, one is struck by the divergence of the results recorded by previous workers. It appears that they have tended to look upon the spiracles only in connexion with gaseous exchange (oxygen and carbon dioxide). Respiration, however, also entails a water metabolism.

Feeling that the tracheal system may have an importance hitherto overlooked in the water balance of the insect, both in respiration and temperature control, efforts have been made to assess the various avenues of water exchange, using larvæ and pupæ of *Galeria mellonella* (Lepidoptera). Preliminary experiments show that a large part (a first approximation gives 50 per cent of total) of the water exchange occurs via the trachea and spiracles.¹

The results obtained may help to explain the different observations upon spiracular behaviour at increased temperature. Thus, while at one time the spiracle may be opening to deal with an increased gas exchange at increased temperature, it may later begin to close to avoid injurious desiccation.

The problem is complicated by the increase in the rate of gaseous diffusion at high temperatures, which tends to overcome the need of spiracular opening. The experiments performed, however, give generally concordant results and uphold the idea put forward very well. The technique is simple and allows of concurrent observations on the localisation of carbon dioxide exchange, and it is hoped to shortly publish a full account of the results.

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¹ Buxton, 1930. *Proc. Roy. Soc. Lond.*, B, 106.

Preparation and Mounting of Deliquescent Substances

CERTAIN deliquescent crystals were required for structural investigations. The following method of preparation and mounting was found satisfactory.

A tube 1.5 cm. in diameter was drawn down at one end to a short tube 0.75 cm. across, and at the other to a capillary. The apparatus was warmed and a stream of dry carbon dioxide was passed through from the capillary end. When the apparatus was dry, the substance to be sublimed was introduced, the gas flow stopped, and the end of the narrow tube sealed. The capillary was then attached to a 'Hyvac' pump, the apparatus evacuated and sealed off.

The tube was heated in an air oven until good crystals were obtained. When cool, a scratch was made at the base of the narrow tube, and a piece of thin rubber tubing was slipped over it until it gripped the wide tube. The rubber tubing was connected to the supply of dry carbon dioxide. The tube was then broken at the scratch, thus filling the apparatus with dry gas. The broken glass was pushed down the rubber tubing until a sufficient length was free to be clipped. The end was then cut off, and a piece of lithium glass tube, drawn down to a capillary at one end, was inserted, carbon dioxide being passed meanwhile. The capillary was then sealed and the clip removed. A piece of stout wire was pushed through the rubber and used to dislodge the crystals, one at a time. After dropping into the capillary tube, they were sealed off separately. The crystals are liable to move unless the tube tapers.

Slight changes in technique enabled crystals grown from solution or fusion to be mounted in the same way.

When optical measurements were to be made, the crystal was dropped into a small spherical bulb blown on the end of a short tube. A fine glass rod dipped into tap fat was passed through the hole in the rubber, and the crystal, suitably oriented, was picked up on the end of this. The rod was then melted into the side of the tube, and the whole sealed off.

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