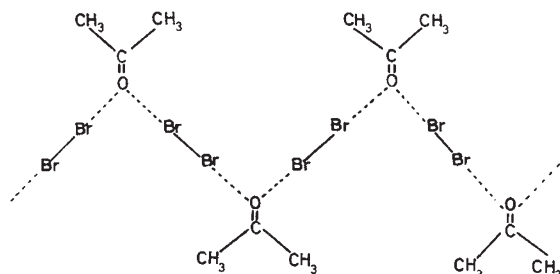


possessing more than one lone electron pair such an arrangement would not appear to be impossible.

The 1:1 compound between acetone and bromine actually affords an example of this kind. According to new results the crystals of this compound contain endless chains of the type:



Here, both lone electron pairs belonging to a particular keto oxygen atom evidently take part in halogen bond formation. The keto carbons and oxygens and the bromine atoms belonging to the same chain are coplanar and the O—Br—Br—O arrangements strictly linear. The methyl carbons do not appear to lie exactly in the plane of the other atoms of the chain. This is probably so because otherwise the distances between methyl carbons and bromine atoms would be energetically unfavourable. The Br—Br distance appears to be very little different from the distance observed in the free molecule (2.28 Å.). The O—Br distance was found to be 2.82 Å. and the Br—O—Br angle nearly 110°. Details of the structure determination will be published elsewhere. The space group is $C2/c$ and the lattice parameters are as follows:

$a = 7.12$ Å. $b = 7.48$ Å. $c = 12.90$ Å. $\beta = 111.5^\circ$
The unit cell contains four molecules.

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¹ Hassel, O., and Hvostef, J., *Acta Chem. Scand.*, **8**, 873 (1954).

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Boron-10 Abundance in Nature

THE most reliable values for the isotopic abundance of boron-10 in naturally occurring minerals have been derived from mass spectrometer measurements. Results quoted by different workers, however, range from 18.4 to 19.9 per cent boron-10, and it is not difficult to find possible causes for the variation. Most of the measurements have been made with boron trifluoride, which is a difficult compound to handle in a mass spectrometer, since memory effects and interference from impurities can give very erratic and incorrect results; even when there are no errors of this kind, it is still possible for results to be biased by mass discriminations in the mass spectrometer, and no reported attempts have been made to standardize the results in any way. Insufficient care when preparing samples from the natural minerals could also cause errors arising from discrimination with respect to one isotope. The possibility of variation of the abundance of boron-10 in Nature has been investigated by Parwel *et al.*¹, who examined a large

number of minerals and found only a slight difference for boron obtained from sea water.

Among the more recently reported results, Osberg² quotes a constant value of 19.6 per cent boron-10 for a small number of minerals examined. Panchenkov and Moissev³ quote 18.4 per cent boron-10 for (presumably industrially prepared) boron trifluoride. Kilpatrick *et al.*⁴ claim to have eliminated their mass discriminations and quote 18.8 per cent boron-10 for industrially prepared boron trifluoride.

In order to make a check on mass spectrometer discriminations and to obtain a more accurate figure for the natural abundance of boron-10, we have prepared standard samples of boron trifluoride with known isotopic content. Primary standards were prepared by blending enriched and depleted boron trifluoride in known proportions, and these were compared with bulk secondary standards using a mass spectrometer. We later compared the appropriate secondary standard with a sample of boron trifluoride which had been carefully prepared from naturally occurring boron. This sample has been shown by Parwel *et al.*¹ to contain boron with the same isotopic composition as that obtained from all the other minerals they examined; we are indebted to H. von Ubisch of A. B. Atomenergi, Stockholm, for supplying this sample. Our results show that the mass spectrometer discriminations, expressed as a fraction of the isotope ratio, are the same for both enriched and natural boron trifluoride, as might be expected. The naturally occurring boron sample was found to contain (19.3 ± 0.1) per cent of boron-10.

A more detailed account of the preparation of the isotopic standards and of the mass spectrometer measurements will be published elsewhere.

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² Osberg, O., *Z. Phys.*, **128**, 366 (1950).

³ Panchenkov and Moissev, *Zhur. Fiz. Khim.*, **30**, 1118 (1956). (Translated in U.S.A.E.C. Translation *AEC-tr-2974*.)

⁴ Kilpatrick, M., Hutchinson, C. A., Taylor, E. H., and Judson, C. M., "Separation of the Boron Isotopes". National Nuclear Energy Series, Div. III, Vol. 5. (Oak Ridge, Tenn.: U.S.A.E.C., 1952).

Surface Concentrations of Manganese Nodules

MANGANESE nodules were investigated during the Downwind Expedition, a part of the International Geophysical Year programme of the Scripps Institution of Oceanography of the University of California. Attempts were made to collect bottom photographs, cores and dredge hauls in the same areas, to measure the distribution at the surface and in depth, and to obtain large samples for physical and chemical analysis.

Although nodules were sampled and photographed in various places along the expedition track between California, Tahiti and South America, the greatest concentration was found on the red clay bottom deeper than about 4 km. in the south-western Pacific Basin. Nodules had been discovered in the basin by the *Challenger* eighty-five years before. The two ships of the expedition followed the track of