

Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 978.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Nitrogen and Argon in the Earth's Crust

IN a recent letter¹, it was stated that various specimens of granite contain per gram about 10^{-6} c.c. of neon and 4×10^{-6} c.c. of argon. This makes the ratio neon/argon some thirteen times as great as in the atmosphere.

The same rocks and a considerable number of others have now been examined for nitrogen. The quantity found is remarkably uniform, and amounts to about 3×10^{-2} c.c. per gram. Various evidence indicates that the nitrogen is not occluded like the argon and neon, but is for the most part held in chemical combination.

The ratio argon/nitrogen comes out about 1.3×10^{-3} . The atmospheric ratio is about 1.2×10^{-2} , some nine times greater.

It appears from these nitrogen determinations that, contrary to what has been supposed, the total nitrogen in the earth is many times more than in the atmosphere. It has been estimated² that 0.65 of the earth's mass consists of rock. On this basis, it may be calculated that the rocks contain thirty-seven times as much nitrogen as the atmosphere.

Discussion of the cosmological bearing of these results is deferred.

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May 12.

¹ NATURE, 141, 410 (March 5, 1938).

² See, for example, Russell, H. N., "The Solar System and Its Origin" (New York: The Macmillan Co., 1935), p. 56.

Absorption Bands and Electron Transitions in Coloured Fluorites

THE absorption spectra of fluorites coloured by natural or artificial irradiation show, in general, principally two regions of strong absorption¹: from 350 to 470 $m\mu$ and from 530 to 650 $m\mu$. The latter has already been attributed to reduced calcium, either as isolated atoms or as colloidal particles; the former can now be attributed to the bivalent ions of the rare earth elements, which, as has been shown before², are responsible for the diffuse fluorescence bands of fluorites. The blue Eu^{++} -band has its maximum of excitation³ in the region of 350–390 $m\mu$, the red band of Sm^{++} in CaF_2 , most likely towards 430 $m\mu$. The red Sm^{++} -fluorescence of some natural fluorites is connected with absorption maxima between 420 and 470 $m\mu$. The different colours of fluorites can now be explained by the varying intensities of the different absorption maxima: Eu^{++} alone gives a light yellow colour (for example, Derbyshire), Sm^{++} a deeper yellow brown (Wölsendorf and others), the bivalent rare earths together with the Ca-maxima give the green colours (Wear-dale), predominance of the Ca-maxima the blue and violet colours, violet corresponding to a more disturbed lattice (larger colloidal particles?).

Various colour changes through heat or light can be attributed to the transfer of electrons from the bivalent rare earth ions to the calcium ions and back, for example, the 'improving' of the colour of greenish fluorites by exposure to sunlight⁴, which gives deeper purple colours: reduction of calcium by electrons given off photo-electrically by the bivalent rare earths. In some yellow and green fluorites, this transfer is reversible at low temperatures⁵: irradiation with ultra-violet light in the rare earth maximum diminishes this and builds up the calcium maximum (violet colour); irradiation in this maximum by yellow light reproduces the original colour. This return is accompanied by luminescence and one can, in this case, regard the 'excited' state of fluorite as due to the transfer of electrons from the bivalent rare earths to the calcium, that is, to a chemically different constituent.

Another example of this electron transfer is perhaps given by certain fluorites that fluoresce red (Sm^{++}) in their natural state. This red fluorescence is sometimes increased by heating the sample⁶, the electrons returning from the Ca-atoms to the Sm^{+++} -ions and reducing them to Sm^{++} , an effect that can also be obtained by artificial radium treatment.

If circumstances allow, a more detailed account will be given elsewhere.

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April 5.

¹ Yoshimura, J., *Sci. Pap. Inst. Phys. Chem. Res.*, 20, 170 (1933); Mollwo, E., *Götting. Nachr.*, N.F. 1, 79 (1934); Eysank, E., *Wien. Ber.*, IIa, 145, 387 (1936); and unpublished results by M. Belar.

² Przibram, K., *NATURE*, 139, 329 (1937); and the summary in *Z. Phys.*, 102, 331 (1936); 107, 709 (1937).

³ de Groot, W., *Arch. Neerland.*, IIIa, 7, 207 (1924); and unpublished results by Eckstein, H. Ph. For the colour and absorption of the pure salts and solutions of the bivalent rare earths, see McCoy, H. N., *J. Amer. Chem. Soc.*, 58, 1577 (1936); Butement, F. D. S., and Terry, H., *J. Chem. Soc.*, 1112 (1937); Ephraïm, F., Jantsch, G., and Zapata, Cl., *Helv. chim. Acta*, 16, 261 (1933).

⁴ Sweet, J. M., *Mineralog. Mag.*, 22, 257 (1930).

⁵ Przibram, K., and Haberlandt, H., *Wien. Anz.*, (Dec. 6, 1934); Kellermann, E. W., *Wien. Ber.*, IIa, 146, 115 (1937).

⁶ Haberlandt, H., *Wien. Ber.*, IIa, 146, 1 (1937).

Velocity of Sound in Liquid Helium

THE velocity of sound in helium I and helium II has been determined by a method similar to that used by Pitt and Jackson¹. Standing waves were set up in the liquid between a vibrating quartz crystal and a brass reflecting plate. The crystal was driven near its natural resonance, at a frequency of 1,338 kilocycles per second, maintained constant by means of a quartz crystal master oscillator. The reflector was moved by means of a micrometer screw, and as it passed through the nodal positions, the existence of the standing waves was shown by the resonant reaction on the vibrating crystal. Sharp and easily measurable resonance peaks were obtained