Taking these results together, it may be concluded with considerable assurance that the product of fast neutron bombardment of lead is in fact actinium C″, and that very probably neither in this bombardment nor in the slow neutron bombardment of thallium is any evidence for the production of Tl^{206} forthcoming. This last conclusion is in agreement with the previous assignment[3] of the 4·1 min. activity to Tl^{204}. If the difference between the half-life of actinium C″ (4·7 min.) and that of thallium (4·6 min.) is real, it is consistent with the simultaneous formation of thorium C″ and actinium C″.

The neutrons used for preliminary irradiation were obtained from lithium bombarded with 100 μ amp. of 0·9 Mv. deuterons in the Cavendish High Voltage Laboratory, with the exception that for the final bombardment of the large quantities of lead nitrate, the cyclotron supplied the neutrons (Li + H^2 of 9 Mv., 5–10 μ amp., 10 min. exposure).

It was originally planned to supplement the experiments described above with absorption measurements, but the present emergency prevented us from doing so.

We are much obliged to Mr. D. C. Hurst and Mr. R. Latham for operating the cyclotron for us.

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Dependence of Thermal Diffusion on the Concentration Ratio

IN the design of experiments to separate isotopes by means of thermal diffusion, as for example by the highly successful continuously convective method devised by Clusius and Dickel[1], much depends on the value of α, defined by $\alpha = k_T/c_1c_2$, where c_1 and c_2 are the volume-fractions of the constituents 1 and 2 (so that $c_1 + c_2 = 1$), and k_T is the thermal diffusion ratio; α, which may be called the thermal diffusion *factor*, determines the magnitude, and its sign determines the direction, of the thermal diffusion.

Though the main features of the dependence of α on the molecular mass-ratio and (where the masses are equal) the diameter ratio have long been known, no systematic examination of the characteristics of α has hitherto been made. I have recently made such an examination of $[\alpha]_1$, the first approximation to α according to the Chapman-Enskog theory; this first approximation is correct within a few per cent, so that the results of the examination (which will shortly be published) are likely to be valid, to a high degree of approximation, for α itself. Some unexpected possibilities have thus been discovered.

One factor in α depends solely on the law of interaction between the unlike molecules. This factor, and therefore α itself, vanishes when the interaction is according to the inverse fifth-power law; for inverse-power laws of index higher than 5 (including rigid elastic spheres) the factor is positive, and for a lower index it is negative. The sign of the remaining factor in α has hitherto been tacitly supposed independent of the concentration-ratio c_1/c_2, and all the experiments so far made on thermal diffusion have supported this view. It now appears, however, that this is not necessarily true, and that α may change sign (once) as the proportion of either constituent increases from 0 to 1.

Moreover, it appears that in certain cases $[\alpha]_1$ may vanish for all concentration-ratios, although the mutual interaction is not according to the fifth power law, and the molecular masses and diameters are not equal.

If the method of Clusius and Dickel were applied to mixtures of gases for which α changes in sign as the concentration-ratio varies, the concentration-ratio c_1/c_2 would not tend to 0 at one end of the tube and ∞ at the other (corresponding to the pure gases), but at one end of the tube the ratio would tend to the value for which α changes sign. Though this will not occur for isotopic gas-mixtures, the phenomenon is of much theoretical interest, and worthy of experimental investigation.

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Submarine Geology and Geophysics

THE brief article by Dr. Bullard entitled "Geophysical Study of Submarine Geology" which appeared in NATURE of May 18, p. 764, was gratifying in that it directed attention to some of the developments in the newest field of geological research. On the other hand, this article showed a pardonable lack of familiarity with many developments, particularly with work along the California coast carried on with the facilities of the Scripps Institution. Since the tentative conclusions suggested by Dr. Bullard are in no way confirmed by these investigations, a brief summary of the work and its implications might prove of interest to the readers of NATURE. To date only brief summaries of this work have been published, but forthcoming publications by the Geological Society of America can be consulted for amplification.

Dr. Bullard referred to the excellent charts which have been prepared by the U.S. Coast and Geodetic Survey showing the submarine canyons which cut the submarine slopes off the American coasts. These charts have been used as a basis for oceanographic investigation of the submarine canyons on the auxiliary ketch *Atlantis* off the east coast and on the auxiliary schooner *E. W. Scripps* off the California coast. Since 1933, I have devoted a large amount of time to making minutely accurate charts of the canyon heads off California and in collecting samples of sediment and rock from the canyons and vicinity. Also accurate range lines have been established and checked many times to look for changing depths within the canyons. During 1938 approximately six months of cruises on the *E. W. Scripps* were devoted to this work.

The *E. W. Scripps* is equipped with a gravity coring device designed by K. O. Emery and R. S. Dietz, which obtains cores up to 10 ft. in length, equalling those obtained by the Piggot gun, which, contrary to the impression given by Dr. Bullard, has not obtained 10-ft. cores in rock but in oceanic ooze. Hundreds of cores have been obtained with this