plained and exhibited the process of separating krypton and xenon, showing that a proportion of less than a millionth of these constituents in the atmosphere can be condensed and concentrated in charcoal cooled to the temperature of liquid air. Turning again to Prof. Rutherford's letter, his surprise about the absorption of the emanation of radium, thorium, and actinium by charcoal on the ground of being inert gases may be dismissed as nothing more than what we should anticipate; but the temperature at which the absorption by charcoal takes place raises some important questions.

To take an illustration (Proc. Roy. Inst., 1905), I have shown that charcoal cooled in solid carbonic acid at the temperature of 195° ab. is capable for a time of absorbing the carbonic acid present in air (amounting to, say, 3/1000 of an atmosphere) until the concentration rises to about 1 per cent. of the weight of the charcoal. If, on the other hand, the separation of the carbonic acid from the air had to be done by cooling alone, then the temperature of the air must be reduced below 129° ab., and about 100° ab. it would for practical purposes be nearly all removed. Thus charcoal about twice the absolute temperature required for condensation by mere cooling is for a small concentration of the gas undergoing absorption equally effective. We can compare now the behaviour of the radium emanation with that of carbonic acid. In the paper of Rutherford and Soddy on the condensation of radio-active emanation (*Phil. Mag.*, 1903) it is shown that the temperature has to be lowered below 138° ab. in order to condense the radium emanation, while it is complete by 123° ab. By analogy, therefore, we anticipate that at twice 138° ab. charcoal would still act as a condensating agent. This, then, brings us up to about the ordinary temperature, just what Rutherford has found to be sufficient. Such comparisons, however, may not necessarily mean that the radium emanation is comparable in volatility with carbonic acid at low temperatures.

The results of Rutherford and Soddy would seem to show that the radium emanation has a high latent heat of volatility, and consequently by all analogy a high boiling point. Thus they say (*Phil. Mag.*, 1903) that the radium emanation begins to volatilise at 118° ab., and by 119°·5 ab. the amount is increased four times. If we accept the view that the partial pressures of the emanation were in the ratio of one to four at the two temperatures given above, then we may apply the Rankin formula ($\log P = A - B/T$, where A and B are constants, P the pressure, and T the absolute temperature) and find the order of the value of the B which is proportional to the molecular latent heat, which in this case comes out 5662. Taking, again, the relative electrometer leaks by the statical method of 5, 3 at 126°·5 ab. and 0, 74 at 124°·5 ab., this gives 6735, which is of the same order of magnitude. The following values of the B constant for different bodies are useful for comparison:—

| | B constant |
|---|---|
| Sulphur (solid) | 4599 |
| Mercury (liquid) | 3170 |
| Phosphorus (liquid) | 2570 |
| Carbonic acid (solid) | 1353 |
| Argon (liquid) | 339 |
| Xenon (liquid) | 669 |

The calculated value of the B constant of the radium emanation is, then, twice the value for mercury and nine times the value for xenon. We need not press, however, the accuracy of the latent heat constant of the radium emanation too far, so let us divide it by two, which will make it of the order of the latent heat of mercury or phosphorus. Accepting for the moment such a value of the molecular latent heat, we cannot avoid inferring that the boiling point of the emanation may be relatively higher than one at first might anticipate. Even if we assume that the emanation represents a gas two steps higher in the periodic series than xenon, the B constant would by analogy be only a little more than 1000. The latent heat argument supports the view that the molecular weight of the emanation must also be high, and of the order of 200 or above it. Naturally the theoretical argument based on the value of the latent heat constant fails if it is not legitimate to use the electrometer measurements of Rutherford and Soddy as being equivalent to the ratios of the partial pressures of the radium emanation. JAMES DEWAR.

Royal Institution, October 29.

### Radium and Geology.

FULLER consideration of the experimental evidence on the effects of concentration on the activity of radium convinces me that, on the whole, this is certainly against the *a priori* probable assumption that a large part of the activity is not spontaneous. I refer more especially to Prof. Rutherford's experiment on dilution, as touched on in my letter in NATURE of October 25. Other considerations lead to the same view.

The conclusion at issue is, however, too important to be left on the existing experimental basis. J. JOLY.

Geological Laboratory, Trinity College, Dublin.

### The Evolution of the Colorado Spiderwort.

UNTIL recently the name *Tradescantia virginiana*, of Linnæus, was made to include a multitude of forms, without discrimination. However, as we go from east to west we observe a marked change in the spiderworts, corresponding with an equally marked change in climate. The more eastern forms of moist regions are tall and rank, with bright green foliage. The true *virginiana* has the pedicels and sepals villous, the hairs not glandular, and does not in any way suggest a xerophyte. In the middle west are two forms, *T. occidentalis* (Britton), bright green, but with narrow leaves and usually smaller flowers, the pedicels and sepals with gland-tipped hairs, and *T. reflexa*, Raf., glaucous, the pedicels glabrous, the sepals with a tuft of hairs at the apex. The latter is more especially southern, and is said to extend even to Florida. Still further west we find in New Mexico another form, *T. scopulorum*, of Rose, slender and much branched, glaucous, with glabrous pedicels and smooth sepals. Still again, we have in Colorado a distinct plant, which I have named *T. universitatis*.[1] This is strongly glaucous, robust, but not very tall, pedicels glabrous, with a very few gland-hairs, sepals glandular-pilose. The leaves are broad (the sheathing bases 12 mm. to 13 mm. wide), and the flowers are about 35 mm. across. There is no sign of any tuft of hairs at the apex of the sepals.

In all this we have a series of changes, not always simultaneous, from bright green to glaucous, and from simply villous pubescence to gland-tipped hairs. In some cases the leaves become narrower and the flowers smaller. It is easy to see in all this direct adaptation to drier conditions,[2] but it is not so easy to determine how it came about, or how far it may result from immediate influences modifying individuals of a plastic type. At Boulder, Colorado, the *T. universitatis* is a plant of spring and early summer, and has the characters just referred to. This year, however, a ditch was dug right through a place where the plants abounded, and many of them were covered up by the earth thrown out. To-day, September 30, I find that these plants have managed to sprout through the covering soil, and are now in full bloom. They are typical, except in one conspicuous character—the pedicels and sepals both are profusely gland-hairy. If one received these specimens, with the mere statement that they were gathered on the last day of September, noticing the profuse pilosity as well as the unusual time of flowering, one would readily take them for a distinct thing.

There seems to be some confusion about the plant originally named *occidentalis* by Britton. As first described, it was said to have narrowly linear leaves, and the first locality cited was Wisconsin. Rydberg, in his recent "Flora of Colorado," gives it a quite different range, no further east than Nebraska, and makes it include the Colorado plants. The name must go, however, with the plant originally described. T. D. A. COCKERELL.

University of Colorado, Boulder, Colorado,
September 30.

[1] Type locality, the Campus of the University of Colorado, at Boulder. Also common on the Campus of Colorado College at Colorado Springs.

[2] And, in part, more saline soil?