From the foregoing it seems probable that ordinary magnetic attraction and hysteretic repulsion determine between them the behaviour of particles in the field of an alternating-current magnet. Of these two factors the former is fairly understood; it remains to indicate one or two points concerning the latter. Hysteretic repulsion is low and attraction relatively high when the frequency of alternation is low, and *vice versa*; Mr. Mordey found that, with an increase of frequency from 25 to 75 periods, the speed at which the material was repelled increased approximately as the square of the increase in frequency. At higher frequencies, however, repulsion appears to be again inactive; Mr. Mordey, for example, found that both at 150 periods and at 350, repulsion was not manifest but attraction, even hæmatite remaining over the poles. He used relatively low inductions, 560 to 2000, these being more proper to alternating current than the higher inductions associated with direct current in ordinary magnetic separation.

The continuous repulsion of the ferriferous particles across the stream is forceful and unhesitating, whether these particles be dry or borne in water; it is assisted by an upward repulsion which frees them from entanglement with associated gangue, and gives them power to climb an inclination or even the sides of the container. At the same time, however, these particles, and particularly those of magnetite, tend to be held strongly in the plane of their movement, so that unless the field be properly adjusted transverse walls or banks form such as hinder the escape of gangue.

To make use of this discovery Mr. Mordey has in mind a shallow inclined launder down which the material would flow in the condition of an ore-pulp. With poles running the length of this launder the ferriferous particles would be driven to one side, to be collected separately at the bottom, the gangue particles keeping a straight path.

It is interesting that only iron minerals have so far been found capable of making the transverse movement, such moderately magnetic minerals as ilmenite and wolframite not moving; it is also of interest that, though magnetite moves more strongly, hæmatite can hardly be said to be outclassed; further, a small contamination with iron oxide causes other minerals to move, wolframite and cassiterite, for instance.

Obviously, therefore, though magnetic susceptibility is doubtless involved it does not enter unfettered; as already stated, it is associated with hysteretic repulsion. That the repulsion may be due to eddy currents set up in the particles appears to be excluded by the fact that the conductivity of hæmatite is not high enough to permit any pronounced development of such currents; moreover, particles of metallic aluminium, the conductivity of which is very high, are not repelled.

It is to be hoped that this process of magnetic separation may so develop that deposits, such as that at Dunderland, Norway, which contain much hæmatite in addition to magnetite, and others consisting largely of granular hæmatite, may be successfully treated. In view of the many deposits coming within these descriptions, and of the fact that the present means of magnetic separation, good as they are for dry work, fail entirely to separate feebly-magnetic minerals from a water-borne pulp, any endeavours to realise this hope will be viewed by all with the greatest sympathy and interest. The ordinary magnetic concentration of magnetite is not an expensive treatment, but the treatment outlined by Mr. Mordey, being simplicity itself, would cost still less.

Obituary.

PROF. J. C. BRANNER.

PROF. JOHN CASPER BRANNER, president emeritus of Stanford University, California, died at Palo Alto, California, on March 1, in his seventy-second year. He was a geologist of stimulating activity, and was attracted to Brazil as a young man in 1874 through his master at Cornell, C. F. Hartt. In 1875 he succeeded Hartt as director of the Imperial Geological Commission in Brazil, and, on the establishment of the republic, continued his observations in that country on various expeditions from time to time. In 1885 he was appointed professor of geology in Indiana University, and in 1892 to the similar post in the newly founded Stanford University. He won a considerable position as an economic botanist, and his geological papers cover a wide and practical field. His "Outlines of the Geology of Brazil," the second edition of which was published in the Bulletin of the Geological Society of America as recently as 1920, has been noticed in NATURE, vol. 106, p. 58. This very useful summary includes a geological map of the whole country on the scale of 1 : 5,000,000.

Many European geologists will remember Branner at the International Geological Congress in Zürich in 1894, and all who met him must have been won by his strong personality and his equally strong and manly presence. It is characteristic of his outlook that in his most recent treatise he hopes that his work may be of service to the Brazilian people, "to whom I am strongly attached, and in whose welfare I am deeply interested."

We owe some of the facts and dates in the foregoing notice to an appreciative article by Dr. David Starr Jordan in *Science* for March 31, and to an obituary notice in the *American Journal of Science* for April.

DR. ANDREW MCWILLIAM, C.B.E.

THE death of Dr. Andrew McWilliam, which occurred on April 5, came as a shock to a large circle of friends and former pupils, and deprives the steel world of a metallurgist of great knowledge and wide experience. A native of Galloway, Dr. McWilliam was educated at Allan Glen's School, Glasgow, and at the Royal School of Mines, of which he became an Associate. On leaving South Kensington, he entered the Sheffield Technical School, afterwards incorporated with the University of Sheffield, but later he left to take up in succession several outside posts. Returning to Sheffield, he was first appointed lecturer, and then assistant professor,

©1922 Nature Publishing Group