Weather Changes as Indicated by Variations in the Earth's Magnetic Field

In 1927 this department began a series of studies on the astonishing electrical effects that accompany sandstorms in West Texas. The question naturally arose: "Do these sandstorms give rise to, or are they accompanied by, magnetic effects?" In 1932 we constructed a laboratory of non-magnetic materials at a distance of 210 yards from the nearest building, power line, or pipe line; and installed a horizontal Askania magnetometer.

During the winter of 1933–34 J. Preston Conner, one of our graduate students, took some preliminary readings. He read a paper on this subject at the Lubbock meeting of the Southwestern Division of the A. A. A. S. on April 30, 1934. During the summer of 1934 Kimsey Miller made a series of observations in connection with his master's thesis. From October 3, 1935 to May 9, 1936, readings have been taken from three to six times per day with the exception of two periods of two weeks each, and excepting about one-half of the Sundays. Some results of these readings were given in a paper read by Florence Robertson at the Flagstaff meeting of the S. W. Division of the A. A. A. S. on April 28, 1936.

At a meeting of the A. A. A. S., Southwestern Division, Technical section, at Albuquerque in 1930, Mr. Harry A. Aurand read a paper on the relation between variations in the magnetometer readings and changes in the weather. Apparently this paper was not published, and was entirely unknown to the authors until our work was well under way.

Before discussing our results it should be stated that at Lubbock, Texas, the average annual rainfall is 18.6 inches. Most of this comes in the summer and early fall. During November, December, and a good part of January the weather is apt to be fair; a part of this time ideal. During February, March and April sand storms are of frequent occurrence.

As a result of our observations we have arrived at the following conclusions which seem to verify those of Mr. Aurand, and go somewhat beyond them:

(1) In about 95 percent of the cases observed a high magnetometer is followed by bad weather (rain, snow, sleet, hail, thunder, lightning, sandstorms, dust storms, violent winds, cold waves, etc.). In the majority of cases the rise in the magnetometer came about a day in advance of the adverse weather change.

(2) In about 57 percent of the cases observed a low barometer is followed by bad weather. The falling barometer, when it occurred, preceded the bad weather by a much shorter interval of time than the high magnetometer.

(3) It would thus appear, that insofar as West Texas is concerned, the magnetometer is a very much better indicator of bad weather than the barometer.

In addition to the above we have noted the following:

(4) At Lubbock, Texas, the diurnal variation in the horizontal component of the earth's magnetic field is almost the reverse of that found at various observatories in the northern hemisphere.

(5) There are some indications that exceptionally low magnetometer readings accompanied earthquakes in various parts of the earth, particularly those in Montana in the fall of 1935.

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Evidence for the Existence of Na^{22}

Sodium is generally considered to be a simple element of mass number 23. The best test of its simplicity has been made by Bainbridge[1] who found that the mass numbers 21 and 25 could not be present to the extent of 1 in 3000 and 22 to the extent of 1 in 800.

Recent mass spectra obtained in this laboratory show a small peak in the 22 position. Representative results are illustrated in Fig. 1.

The peak observed at 22 is proportional to Na^{23}, the abundance ratio being close to $Na^{23}/Na^{22}=5000\pm500$. No peaks were in evidence at 20, 21, 24, and 25, the sensitivity being about 1 in 50,000.

The technique was essentially the same as that employed in the detection of Li^5.[2] The ion source in these experiments was a platinum disk which had been impregnated with sodium by heating in contact with Na_3PO_4. All adhering salt was carefully scraped from the disk before installing in the spectrograph. In the detection of faint peaks of this type it is essential that the disk be smooth and that the slits be free from tarnish since both of these tend to broaden the peaks and increase the background.

It seems probable that the observed peak at mass 22 is due to Na^{22} since it was proportional to Na^{23} and since calcium was completely absent, thus precluding the possibility of the peak being due to doubly charged Ca^{44}. The only peaks observed other than those at 22 and 23 were those due to potassium; the magnitude of the 22 peak, however, showed no relationship to the potassium current.

A similar test was made on caesium but no new isotopes were observed. In the case of rubidium no evidence was obtained for the existence of Rb^{86}; this confirms the results recently obtained by Nier.[3]

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1 K. T. Bainbridge, J. Frank. Inst. **212**, 317 (1931).
2 A. Keith Brewer, Phys. Rev. **49**, 635 (1936).
3 A. O. Nier, Phys. Rev. **49**, 272 (1936).

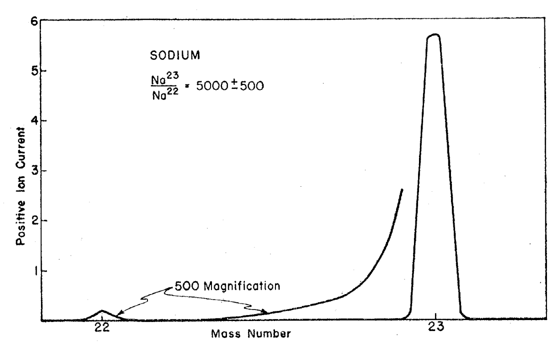

FIG. 1. Mass spectrum of sodium.