lized as double magnesium nitrates. Very pure neodymium and samarium, the latter subjected to further purification by other methods, were sent to the Bureau of Standards at Washington for use in an extensive investigation being pursued on the infra-red arc spectra of the rare earths. It was found that a number of identical new lines were present in both samples and the suggestion was made that they might be due to the presence of a small amount of a new element. Eder had noted the same phenomenon. Later, when the ultra-violet arc spectra of neodymium, samarium, and of intermediate fractions containing both, were examined, lines common to all three were found. However, X-ray analysis of those same samples showed no indication of the presence of an element with atomic number 61. Prandtl and Grimm had subjected rare earth material to separation by the same method and then to a fractional precipitation with ammonia, and could find no evidence of the missing element by X-ray analysis.

It seemed that the solubility of the double magnesium salt of 61 is very similar to that of neodymium and its separation by recrystallization of that salt offered little hope of success. The order of solubility of the bromates of the cerium group earths is the reverse of the order obtaining with the double magnesium nitrates and that suggested a means of separating neodymium and thus concentrating 61. It is easier to separate a small amount of one element from a larger amount of a second, if the former is in the less soluble end of the series of recrystallizations. Accordingly the neodymium rich material thought to contain 61 was converted to bromate and again recrystallized.

A marked change in the absorption spectra of the solutions that began to appear after repeated recrystallization indicated the probable concentration of the missing element. Two bands, one at 5816A° and one at 5123A°, that had shown very faintly in supposedly pure neodymium, became stronger in some fractions as the other neodymium bands disappeared. Because these two bands, if assigned to number 61, find their places in a more or less regular sequence shown by bands of neighboring elements it was thought they might belong to that element.

X-ray analysis confirmed the theory and showed the presence of number 61 in those fractions. A mean value of five determinations of 2.2781A° was found for the $L\alpha_1$ line and one determination of 2.0770A° for the $L\beta_1$ line. A faint indication of the $L\beta_3$ line was also noted. It is assumed that these results prove the presence of element number 61.

The name assigned to the element is Illinium (Il).

There are several reasons that may be advanced to explain why the element escaped detection by means other than X-ray analysis. It must be extremely rare. Its solubility in a series of fractional recrystallization is next to that of the very abundant neodymium, which tends to spread into the illinium-rich members of a series. The large number of absorption bands exhibited by both neodymium and samarium would tend to mask its absorption spectrum. Finally the solubility of its double magnesium nitrate, which salt is commonly used for the separation of closely related elements, is close to that of neodymium. Evidence supporting this latter is found in the fact that the absorption bands at 5816A° and 5123A° found in supposedly pure neodymium purified by that method, are shown to belong to illinium.

The identification of illinium as the missing rare earth completes the list of rare earth elements. Work has been instituted involving the extraction of several hundred pounds of the crude material with the purpose in view of obtaining enough of the element in pure enough state to study its properties, its relationship to other members of the group and its atomic weight.

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THE EFFECT OF AN ELECTRIC FIELD APPLIED TO A PHOTOGRAPHIC PLATE DURING EXPOSURE[1]

BEFORE the development of the modern silver bromide plate there were many attempts to increase the sensitivity of photographic processes by the application of an electric field or an electric current to the sensitive material during exposure.[2] In some of these attempts slight changes of sensitivity were detected, and in others no effect was observed. Because of astronomical and spectroscopic applications, it is important to know whether a really significant change of sensitivity can be obtained.

We have performed some experiments on the effect of an electric field applied perpendicular to the surface of the plate under conditions which, so far as we can learn, have not been utilized in previous investigations.

There are at least two ways in which we may hope to produce such a change in plate sensitivity. The first is based upon the fact that when light of sufficiently great frequency falls on silver halide crystals it increases their conductivity,[3] and on the fact that

[1] Published by permission of the director of the Bureau of Standards.

[2] Eder, Handbuch der Photographie, Vol. 1, Part 2, p. 421, (3rd edition), gives references to all the earlier work.

[3] Arrhenius, Sitz. Ber. d. Wiener Akad., II Abteilung, 96, p. 831, 1887. Eder's Jahrb. 9, p. 201, 1895.

they exhibit the photoelectric effect.[4] It is probable also that charges may be liberated inside the gelatine by the action of light. If a potential gradient can be applied to the emulsion, a current will flow and may affect the formation of the latent image in a variety of ways. To realize these conditions, we placed a plate between a sheet of aluminum foil and a sheet of fine meshed nickel gauze, and applied potentials of the order of 1,200 volts to these electrodes, while the plate was exposed to a quartz mercury arc (Labarc). After a few trials we decided to use gold foil for the front electrode, since we found that it transmits down to at least 2,200 A. U. In this way the field could be applied to the emulsion more uniformly, though variations in the thickness of the foil gave a mottled appearance to the exposed portions of the plate. This was of no consequence in judging the relative density of exposures obtained with and without the field, for we are interested only in large changes of sensitivity. The possibility of error due to irregularity of the foil was eliminated by the simple expedient of taking a large number of plates, each with a different piece of foil.

With this arrangement of apparatus, the emulsion was in contact with only one electrode, so we could not expect any effect from the use of a potential applied always in one direction. This would simply result in the charging up of the emulsion. However, for the sake of completeness, both direct current and 60 cycle alternating current were tried.

A second way in which we may hope to increase the sensitivity of a plate is this: Mount a rectangular frame carrying a sheet of gold foil a short distance in front of the emulsion (1 to 2 mm). The other electrode may be in contact with the emulsion or may be applied to the glass side of the plate. If the gold foil is charged to a high negative potential (say 1,200 volts) with respect to the emulsion, photoelectrons liberated from the foil will strike the plate with velocities sufficient to affect it. If the positive electrode is in contact with the emulsion, this effect alone is operative, while if it is applied to the back of the plate we can utilize both the electronic bombardment and the effects due to charges liberated inside the emulsion.

Unfortunately, the efficiency of photo-ionization from solids is extremely low,[5] so that the number of photo-electrons passing from foil to plate may be very small compared with the number of light-quanta transmitted. However, it is known that several hundred quanta are required to render a silver bromide grain developable, while Kinoshita[6] and Svedberg[7] state that only a single alpha particle is needed for each developable grain. We have no data on the photographic efficiency of 1,200-volt electrons, but in view of the energy they possess it seems reasonable to assume that only a few may be required for each developable grain. In the entire absence of quantitative data applicable to the case under consideration, we tried the experiment. Since the gold foil used transmitted only a small percentage of the light incident upon it, conditions favored the detection of effects due to the photoelectrons liberated.

Now that the principles involved are clear, we shall describe the details of the work. A complete series of tests was made with each of the three electrode arrangements described above. With each arrangement we tried both direct and 60 cycle alternating current. The direct current was applied in both directions, and the results were compared, but no difference in the density could be observed. Ordinarily, when we were interested only in comparing the densities obtained with and without the applied potential for a given arrangement of polarities and of apparatus, four rectangular areas were exposed on each plate. The first was exposed without field, the second and third with field, and the fourth without field, to check up on the constancy of the light source.

Separate series of exposures were made to test the effect of applying a field and then exposing to light, or that of exposure followed by the application of a field.

It is obvious that when experiments of this kind are performed in air, photoelectrons from the foil will not reach the plate with velocities corresponding to the full impressed potential; further, the potential which can be applied is limited by the formation of brush discharges through the air. For these reasons all the experiments described above were repeated in vacuo, using a Pyrex tube having a large ground glass joint which carried a fused quartz window. The tube was kept on a mercury diffusion pump while exposures were being obtained. The gas pressure was below that which could be read on a Macleod gauge easily capable of detecting 10^{-4} mm. With this apparatus, direct current potentials of 1,500 volts could be utilized; but, with alternating current, capacity discharges took place at 1,200 volts because of the presence of the vapors of stop cock grease from the ground joint. In view of the absence of any positive results, it was not thought worth while to build an apparatus which would permit the attainment of really good vacuum conditions.

[4] Schmidt, *Annalen der Physik*, 64, p. 718, 1898.

[5] Data of Elster and Geitel (*Phys. Zeit.*, 13, p. 468, 1912), quoted on p. 59 of Hughes's "Photoelectricity," show that electrons liberated from a potassium hydride surface carry only about 1/2300 of the energy of the incident light.

[6] Proc. Roy. Soc. A, 83, p. 432, 1910.

[7] *Photographic Journal*, 61, p. 325, 1921.

In our earlier work we used both Seed 30 and Hammer Lantern Slide plates, but for experiments in vacuo only Seed 30 was tried. No attempt was made to compare densities on different plates; the plates were tray developed, with rocking. In general, the time of exposure was between one minute and three minutes. It could readily be controlled to within one second.

In all the above experiments, the plates showed no change of sensitivity which could be detected by the naked eye. It must be emphasized that this work was designed only to detect changes of sufficient magnitude to be of practical value.

In conclusion we should like to express our indebtedness to Dr. A. S. King, who kindly told us of some unpublished experiments performed a number of years ago by Dr. G. Strömberg, of the Mt. Wilson Observatory. Dr. Strömberg used the emulsion as one electrode, while the other was a blackened sheet of tinfoil on the back of the plate. As in our work, there was no observable intensification of the photographic images.

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THE AMERICAN SOCIETY OF MAMMALOGISTS

THE eighth annual meeting of the American Society of Mammalogists was held at the American Museum of Natural History in New York City from April 27 to May 1, 1926, with approximately 68 members in attendance. Arrangements had been made with the National Association of the Fur Industry for a tour, Tuesday afternoon, through one of the great houses for receiving and caring for raw furs, and also through the largest factory in the country for converting raw muskrat skins into finished "Hudson Seal," both of which proved to be of unusual interest. Other features of the meeting included "Trailing Wild Animals in Africa," Martin Johnson's wonderful new film, this constituting its first showing. Additional moving pictures of note were "The True North," taken in Alaska by Arthur Young, and "Big Game in the Sub-Arctic of Canada," by Captain James Critchell-Bullock, F. R. G. S. At the six sessions devoted to the reading of papers, thirty of these were given, covering a wide range of mammalogical subjects.

The usual annual dinner was held April 28, the speaker of the evening being Ernest Thompson Seton, after which there was an exhibition of new installations of habitat groups under construction at the American Museum.

At the directors' and business meetings the following officers were elected: *President,* W. D. Matthew; *vice-presidents,* G. M. Allen and H. E. Anthony; *recording secretary,* H. H. Lane; *corresponding secretary,* A. Brazier Howell; *treasurer,* A. J. Poole; *editor,* H. H. T. Jackson. Announcement was made of the inauguration of a new bulletin series of the publications of the society, the first of which will appear during the summer.

There were passed resolutions thanking the local committee and institutions for their activities on behalf of the society in connection with the meeting, and in addition, the following:

Whereas, through papers and discussion before the American Society of Mammalogists at its Eighth Stated Annual Meeting, that various agents are at work in importing from one geographic area in the United States to other areas certain species and subspecies of mammals for the purpose of restocking such areas with game or fur-bearing animals;

And, whereas, such action frequently results in an unnatural mixing of species and subspecies, and may result in the establishing of certain species and subspecies far outside of their natural geographic ranges;

Therefore, be it resolved, that the American Society of Mammalogists deprecates such unnatural and dangerous transportation of certain species and subspecies; and be it further

Resolved, that the committee on the conservation of land mammals take whatever steps are feasible to disseminate knowledge on this subject, to bring its attention to proper authorities, endeavor to correct the practice referred to, and to make a report on the matter at the next annual meeting of the American Society of Mammalogists.

Whereas, it has come to the attention of the American Society of Mammalogists that the interesting large mammal fauna of Africa is rapidly being reduced, in the case of many species to the point of extermination;

Therefore, be it resolved, that the society looks with great concern on the continued extermination of African game.

Therefore, be it resolved further, that the committee on the conservation of land mammals shall be authorized and directed to communicate with the African game protective societies of other nations with a view to consulting them as to what conservation measures in this matter can best be taken.

The meeting was concluded Saturday with a luncheon, the members being guests of the New York Zoological Society, and with a tour of the Bronx Park under the guidance of Dr. W. T. Hornaday and other officers of the Zoological Society.

The meeting for 1927 will be held at the Academy of Natural Sciences, Philadelphia, Pa.

A. BRAZIER HOWELL,
Corresponding Secretary
WASHINGTON, D. C.