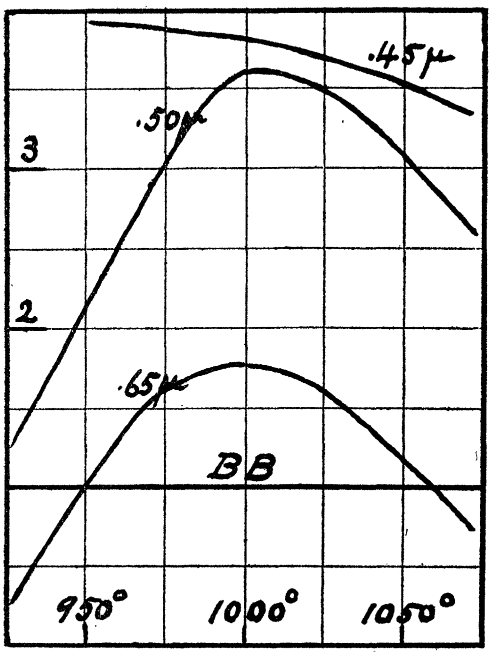
SPECIAL ARTICLES

EMISSION BANDS OF ERBIUM OXIDE: A CONFIRMATION

IN a paper by the late Professor W. G. Mallory[1], published in 1919, a photometric study of the spectrum of glowing erbium oxide was described. When the oxide was heated to 1,000 degrees Centigrade three regions, in which the principal emission bands of this interesting spectrum are situated, were found to be brighter than the corresponding wave-lengths in the spectrum of an ideal black body at the same temperature; the red region slightly brighter and the green and blue several times brighter.

This result has been questioned, although not so far as we are aware in print, on the ground that no radiator can exceed the emission of a black body of the same temperature.



In other words it is held, as a matter of thermodynamics, that the brightest regions in the spectrum of a selective radiator may reach, but never reach beyond, the envelope which encloses the area representing the distribution of radiation from a black body of the same temperature. The explanation offered in Mallory's paper suggests luminescence of the incandescent oxide superimposed upon the ordinary radiation due to temperature.

In the course of studies now in progress, in which an altogether different method is used[2], we find many instances of luminescence superimposed upon the ordinary temperature radiation of incandescent oxides and producing intensities greatly in excess of those of the same regions in the spectrum of the black body. Moreover in the case of erbium oxide we find these excesses in the same regions and at the precise temperature designated by Mallory.

The accompanying figure is from our data for the three regions in question and covers temperatures slightly below 1000°. Intensities are in terms of the brightness of the corresponding radiation from a black body of the same temperature as the oxide and are thus directly comparable with Mallory's results.

While the sample of erbium oxide used by us did not happen to be quite as actively luminescent as in Mallory's experiment the effect is there and is of the same order. His observations are corroborated in every essential respect.

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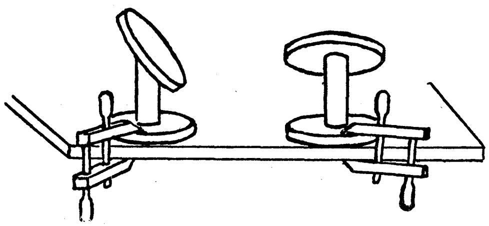
[1] Mallory: *Physical Review* (2) XIV p. 54.

[2] To be described in a forthcoming paper.

LABORATORY DETERMINATIONS OF DIP AND STRIKE

The writer has observed that many geology students are unable to make correct determinations of dip and strike. This weakness seems to be due to the difficulties of presenting the subject in the field, to lack of sufficient laboratory training before entering the field, and especially to lack of suitable apparatus. In the field, the determination of dip and strike appeals to the student as a very minor and uninteresting detail in comparison with the other geological features to which his attention is called. Furthermore, the rock surfaces are usually so irregular that the instructor can not make a very close check of the student's readings. In the laboratory, the tilted drawing boards, table tops, or rock slabs commonly used are not very efficient because they often possess straight edges indicating the line of strike and are usually so insecurely fastened that checking the readings, again, becomes almost impossible. In an attempt to overcome some of these difficulties the writer constructed the following apparatus which has proved so useful and convenient that it is offered as a suggestion to teachers of geology.

This apparatus consists of two circular pieces of wood about eight inches in diameter, connected by a spindle two inches in diameter and eight inches in length. It is fastened to



the edge of a table by means of wooden clamps. Ordinary iron clamps are not used because they cause a deflection of the compass needle amounting to two or three degrees. The absence of straight edges in the outline of the upper disk necessitates finding the line of strike by locating a position of the clinometer in which no inclination is registered and then drawing a line along the edge of the compass box upon a piece of paper fastened to the top board by thumb tacks. The strike line can be changed to all points of the compass by clamping the apparatus in different positions. The dip is constant for each model but, since several models are necessary for an average class, this is taken care of by making each model with a different dip. Models could easily be made with the dip adjustable but such modifications would mean more expense and more trouble in checking students' readings. Furthermore, it is the direction of dip and not the amount which seems to offer difficulties to the student. It has been found that ten models with dips ranging from three degrees to eighty-eighty degrees answer the purpose.

The models are securely clamped in various positions in the laboratory and their dip and strike determined by the student and checked by the instructor. The models are then turned on their bases, clamped, read, and checked again. The students are then required to make corrections for magnetic declinations, assuming that the models are situated in their own region. The readings are again corrected on the assumption that they were taken in Alaska or Ohio or any other place that the instructor suggests. After the student has gained the ability to make accurate determinations on a series of such models, assuming different geographic locations for the purpose of correcting for magnetic declinations, he is fairly well equipped to use the compass and clinometer in the field.

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ARTIFICIAL PRODUCTION OF TIPBURN

Experiments conducted at the Iowa Experiment Station have proved that *Empoasca mali*, the potato leafhopper, is the factor in the production of tipburn or hopperburn of potato. Emulsions were made by crushing a large number of adults of both sexes in water. Small amounts of this material were injected into the leaves of the potato plants and in several days an injury was produced similar to, if not identical with tipburn. Difficulty was experienced in getting large amounts of the emulsion into the leaf tissue, but enough was injected to produce burning. When this emulsion was placed on the leaf and then the tissue pricked with a fine needle, negative results were noted. Emulsions made from crushed nymphs failed to produce injury in more than a few cases, and in these it was not pronounced.

That these insects contain some toxic substance was further demonstrated by placing the residue left over from the insects after the emulsion had been poured off on leaf petioles and then pricking this in by means of a fine scalpel. In every case, a lesion was produced, the tissue at these points first turning yellow and then brown. Later the cells collapsed leaving a rather large scar.

Although Bordeaux mixture is toxic to the nymphs, yet it acts comparatively slowly so that by keeping a leaf sprayed with this compound colonized with live nymphs tipburn was produced. This would appear to show that Bordeaux mixture does not prevent tipburn by its action on the leaf but rather by its action on the insect.

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