land surface is not continued beneath the Cretaceous formation of the Coastal Plain. The much greater slope of the crystalline basement below the Coastal Plain makes the marked angle formed by the intersection of these two surfaces recognizable even when a small vertical exaggeration is used.

When records of scattered well drillings along a line in the Coastal Plain are plotted, they seem to indicate that the crystalline basement closely approximates a plane surface. Very probably the surface of the crystalline basement is a buried peneplane developed during pre-Cretacic (Jurassic?) times. The slope of this buried and tilted Jurassic peneplane emerges from beneath the Coastal Plain sediments, and continues upward along the face of the fall line belt of the Piedmont, being revealed through the stripping away of the Coastal Plain sediments by erosion. The width of this stripped zone is slight, varying from 2 to 4 miles along the Piedmont. In New England, however, the Coastal Plain is entirely removed (except that portion which is below sea-level), leaving a stripped zone varying from 5 to 15 miles in width. The exposed edge of this old Jurassic peneplain is continued across the bottom of the Gulf of Maine with a width of about 15 miles.

Several writers have long known that the slope of the Piedmont is not continued beneath the Coastal Plain and that there are two upland slopes in New England; indeed, Davis himself has recognized this and commented on it. But what is vastly more significant, it has not been recognized that since this is true no falls could result from the conditions embodied in Davis's theory. If, as Davis suggested, the Piedmont rivers had established very gentle gradients leading to an ancient shore-line near the present "fall line," the upland profile and the stream profile must have been intersected at that point. After the emergence of the Coastal Plain, the extended rivers must have entrenched themselves in the soft Coastal Plain sediments until they had established nearly level channels in their lower courses, whereas downcutting proceeded very slowly in the crystalline rocks of the Piedmont. This would have resulted in a broken stream profile in which the stream in the outer (eastern) Piedmont would have been entrenched but little below the upland surface, while in the western Piedmont and the Coastal Plain it would have been greatly entrenched.

But actual profiles show that the streams are entrenched as far below the upland surface in the eastern Piedmont as in the western Piedmont. If this fact is applied to a diagram showing the Piedmont surface as being continued beneath the Coastal Plain it gives only a simple concave stream profile which could yield no falls and rapids whatsoever. Thus the postulate of an ancient shore-line at the fall line is untenable, and the break in stream gradient is only incidentally related to differential entrenchment in areas of unequal rock resistance.

On the other hand, the profiles show that there is a marked break in the slope of the Piedmont-New England upland, and it is at this point that the streams which are *uniformly* entrenched below the upland surface exhibit the break in their gradients.

The fall line zone, therefore, lies along the outer edge of the crystalline area (the Piedmont-New England Upland Province), where there is a break in the slope of the land due to the intersection of the recently exposed margin of the old, tilted Jurassic peneplain and the newer Tertiary peneplain of the uplands. Since the gradients of the streams are closely related to the profile of the land, this break is sufficient to account for falls and rapids.

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## SCIENTIFIC APPARATUS AND LABORATORY METHODS

### PRECIPITATION OF THE VIRUS OF TOBACCO MOSAIC

In an attempt to free the virus of tobacco mosaic from as much contaminating material as possible a method has been devised whereby the freshly cut diseased tobacco tissues are frozen, allowed to thaw, and then subjected to high pressure. The juice obtained, after being centrifuged, at about 2000 r.p.m., contains no large particles in suspension, but is highly infectious.

When two volumes of acetone (c. p.) at $-8°$ C. are added to one volume of the juice held at about 0° C. a flocculent precipitate is thrown out and rapidly settles. The supernatant liquid can be almost completely decanted within two minutes after adding the acetone, leaving the precipitate in the bottom of the container. More water may then be removed by rinsing the precipitate with acetone (c. p.) at $-8°$ C., decanting the acetone and then removing the remaining acetone with absolute ether at $-8°$ C. by rinsing twice and thoroughly draining off the ether. The precipitate thus obtained is readily soluble in distilled water. Experiments in which young tobacco plants were inoculated with this solution showed it to be highly infectious. The first supernatant liquid decanted, on the other hand, when centrifuged to free it from all traces of the precipitate and diluted with two parts of distilled water proved to be non-infectious. The dilution was made in order to bring the concentration of acetone below the point which Allard[1] showed was non-toxic to the virus.

Absolute alcohol may be used in place of acetone under the above-mentioned conditions.

At about 100 per cent. saturation and $-8°$ C. ammonium sulfate salts out from the juice, material which, when filtered off and sucked dry, dissolves readily in distilled water. Plants when inoculated with this solution take the disease. The filtrate when diluted, one to five, has in no case transmitted the disease; although the untreated juice when containing ammonium sulfate solution at a concentration of 3 cc. of a saturated solution to 10 cc. of the juice is infectious.

Solutions of Safranin-O have also been used to precipitate the virus from the plant juice. This gives a quantitative precipitation, which frees the juice of virus.

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## BROWNIAN MOVEMENTS WITH LOW MAGNIFICATION

THE desire having arisen for conspicuous Brownian movements, a variety of materials was pulverized with a view to ascertaining which showed the movements to best advantage. For several reasons mica, particularly in the form of muscovite, was found preferable.

The suspension to be observed may be prepared as follows. A quantity of mica from the edge of a natural slab is ground by a dry emery wheel into an impalpable dust. This is stirred into a graduate of water and allowed to stand for some four hours. After the larger flakes have settled to the bottom, the thin milky suspension is siphoned off, care being taken not to draw off any of the useless residue at the same time. The concentration of the liquid may, of course, be altered as seems convenient by evaporation or dilution.

The liquid so prepared contains particles most of which are so small as to exhibit the Brownian movements. Under a magnification of fifty diameters with oblique illumination from below the microscope stage, the flakes appear as bright scintillating points in a dark field. This scintillation is evidently caused by small angular displacements due to the atomic bombardment; as the flakes rotate, they reflect the light at irregular intervals. Mica is peculiarly well adapted to this method of observation because each thin particle has a moment of inertia small in comparison with its reflecting area.

In such a field, the movements are still conspicuous with a magnification of ten diameters, and have been suspected with the naked eye.

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## SPECIAL ARTICLES

### HYSTERESIS LOSS IN NICKEL OF DIFFERENT GRAIN-SIZE

THE hysteresis loss in specimens of nickel crystals, which varied from one grain per specimen to as high as $2.8 \times 10^6$, has been examined by Sucksmith and Potter[1] and found to increase rapidly as the number of crystal grains increased. Such an effect is not limited to specimens specially prepared as crystals, but may be found as well in strips of ordinary nickel which have been successively cold rolled to thinner and thinner specimens and thus the number of crystals per unit volume increased step by step as well as the hardness.

Of course all metals are crystalline, but in the case of the nickel strips which are cold rolled, it is not until severe cold working is performed that the crystals are more or less aligned[2] in one direction.

The present writer had occasion recently to study some of the magnetic properties of a series of eleven nickel strips reduced to various thicknesses by successive cold rolling. These strips were 57.7 cm. long and about 0.954 cm. wide. The thickest strip was .604 cm. in thickness and the ten succeeding strips were rolled from this thickness to those given by the percentage cold reduction in the following table:

| No. of Strip | Per cent. cold reduction from mill records | Hysteresis loss Ergs/cm³/cycle | Thickness | Chemical Analysis | |
|---|---|---|---|---|---|
| 1 | 0.0 | 10861 | 0.604 | Nickel | 98.88 |
| 2 | 9.7 | 26146 | 0.550 | Iron | 0.56 |
| 3 | 18.9 | 29165 | 0.496 | Manganese | 0.23 |
| 4 | 28.6 | 30538 | 0.435 | Copper | 0.16 |
| 5 | 39.5 | 37526 | 0.372 | Carbon | 0.09 |
| 6 | 50.0 | 38732 | 0.306 | Silicon | 0.06 |
| 7 | 59.5 | 42373 | 0.249 | Sulphur | 0.008 |
| 8 | 69.0 | 43924 | 0.194 | | |
| 9 | 79.0 | 51086 | 0.133 | | |
| 10 | 89.1 | 55144 | 0.070 | | |
| 11 | 93.3 | 55042 | 0.044 | | |

[1] Allard, H. A. *Jour. Agr. Res.* 13: p. 619 (1918).

[1] Sucksmith and Potter, *Nature*, 118, p. 730, Nov. 20, 1926.

[2] Jeffries, *Trans. Amer. Inst. Min. & Met. Eng.*, 70, p. 303, 1924.