Cuba; and such a condition surely occurred in the early course of petrifaction in the superb Dresden cycadeoid Raumeria, being also indicated in stems of the Black Hills Como.

Calcification direct, however, seems precluded in eruptives or mainly ensues under delta or coastal marine influences and conditions, as in "coal balls," in the palms of the Pierre, and notably at the Wealden "log raft" of the Isle of Wight, or on the coast of Australia, as recorded by Mantell. In 1843 Hugh Miller saw the farmers of the Sutherlandshire coast at Helmsdale quarrying and burning (!) for lime the large annular ringed calcified logs of the Oölite. These are mainly conifer forests.

Apparently, where silicified dicots occur at all in fresh-water sedimentaries, their presence has been in some way favored by unusual conditions or influenced by nearness to epicontinental sea-levels or waters. The fossil forests of the Cairo region, known for a hundred years, may be cited; while the dicot forest with Lauraceous types which I found along the Chuska Mountain front of New Mexico may not be an exception. This is the finest older petrified dicot forest thus far found in North America.

Nevertheless, as noted in the Carnegie Institution Year Book for 1930, monosilicic acid thermal in source must account for certain petrified forests; and corollary to the slight decay resistance of dicots, their most typical occurrence is in eruptives, as seen along the slopes of the "Specimen Ridge" above the Lamar River in the Yellowstone Park. Much of the petrified dicot record must hence be lost, since the eruptives which would contain it are, as geologic time goes, most evanescent features; though it could be admitted —is in fact apparent—that, during the post-Jurassic course of both dicot and monocot stem evolution, decay resistance has been somewhat increased. Certainly the palms are freely petrified in sedimentaries after lower Cretaceous time. Albeit in later courses of volcanism, with the decay factors eliminated, and in the presence of both heat and abundant soluble alkaline silicates, the dicots reach as free silicification as conifers, and both are found in the more and more opaline condition. What may be the most recent examples of wood opalization can not have been very well reported, though Pleistocene woods freely occur; while so far as casual observation goes the pre-Miocene forests generally have lost their water content and reach solid chalcedonization.

Nearly all my own earlier field contacts were with the Mesozoic sedimentaries, and there the greater record seemed to lie. But once I became aware of the opalized dicot-conifer record it seemed amazing. It is in fact a record but superficially described. The opaline forests of the eruptives were long just examples of opal to the student of orogeny, indicating earlier thermal conditions and replacements; while in this country at least those botanically informed seldom studied first-hand the occurrences along the remoter mountain slopes. Dependence of opalization on the decay factor got as little attention as the rate of replacement and water loss in the several types of wood, surely a subject of sheer interest.

Time factors being thus undetermined, and observations such as those of replaced pine needles in the kettles about the Yellowstone Lake merely casual, attempts made in laboratories from time to time to mineralize wood have hardly reached dignity of record in chemical journals; while no great industries being dependent on the silicon series, it is still relatively unstudied. Impregnations or siliceous sinter coatings are the merest first stages in wood opalization. Nor would it be a practical scientific solution of the greater problem to stop short of analyses and complete replacements. The nature of siliceous gels, their solubilities, the fact that the action of the soluble alkaline silicates on cellulose is hastened by heat and probably by inequal pressure accelerating capillary flow through impregnating wood, has been evident enough. Long ago Church silicified corals in the laboratory. Nevertheless, the years have gone on without specimens of artificially silicified woods appearing in the laboratory. Such, when they do come, to be convincing should be brought at least to the clear opalization stage, and should have size enough to in some measure determine possible use in the arts.

The brilliant colorings of the opalized and chalcedonized woods of the lavas and ash are always a source of wonder, though long reproduced artificially by means of well-understood technique. But what must astonish much more from any chemico-physical point of view is the even light coloring of large silicified or opalized logs, indicating with dissolving out of the last traces of cellulose a reaction in an abundant and uncolored gel as steady and as well defined chemically as even the segregation of a quartz crystal or a sphere of hyalite. In a study to be brought out by the Field Museum of Chicago I have given what is trusted may prove a needed and readable general account of petrified forests, with adequate references to the literature concerned.

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ON THE BEHAVIOR OF A GLASS PLATE FLOATING NEAR THE EDGE OF A FLAT-TOPPED DROP OF MERCURY

It does not seem to have been noticed that while a thick plate of glass floated on the top of a flat drop of mercury is thrown off by the capillary forces, if it approach the edge, a thin plate, under the same conditions, has a position of stable equilibrium near the edge of the drop. This seems to depend on the constancy of the angle of contact between the glass and the mercury.

Let A B (Fig. 1) be the section of a flat drop of mercury cut by a vertical plane, and let C B (Fig. 1) be a horizontal surface at such a depth that the angle C B D (θ) is the angle of contact of mercury with glass. Consider the equilibrium of the portion of the drop contained between the planes A B, B C and a plane parallel to A B C but unit distance from it. If T be the surface tension, and D the density of mercury, and β the angle to the horizontal of the mercury surface at B,[1] we have for the equilibrium of this portion of the drop since θ is greater than 90° (horizontal components)

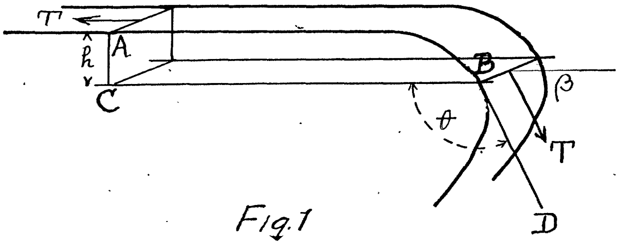

Fig. 1

$$\frac{h^2}{2}Dg - T + T\cos\beta = 0 = \frac{h^2}{2}Dg - T - T\cos\theta.$$

The forces due to atmospheric pressure cancel out.

If a thin piece of glass (say 1 mm thick) be placed on the mercury surface and loaded until it displaces the fluid within the planes specified above, it will rest in equilibrium; for, by Poynting's lemma[2] the horizontal forces on the glass will be the same as if the fluid were not depressed but ran at its level right up to the vertical surface of the glass.

Now, let the load be increased so that the glass sink a further distance h'. The glass at first takes the position shown in Fig. 2, where the resultant horizontal force is to the right, and is due only to the difference in the hydrostatic pressures $(h+h')$ Dg and h' Dg. As soon as these forces have moved the glass so that it projects from the mercury, we have the state of affairs shown in Fig. 3, where, since θ and T are the same constants as in our equation above, the increased hydrostatic pressure drives the glass off the flat surface of the drop. But, if the load be lessened, so that the lower surface of the glass rises above the level of B C in Fig. 1, to depth $\bar{h}$, the fact that T and T $\cos\beta$ have not altered and the term due to the hydrostatic pressure is less, there remains a resultant force that drives the glass to the left. As the line of glass-mercury contact comes to the corner where the glass surface bends sharply upwards, the angle $\bar{\beta}$ (to the horizontal) rapidly diminishes (θ remaining the same) and we get a position of equilibrium where

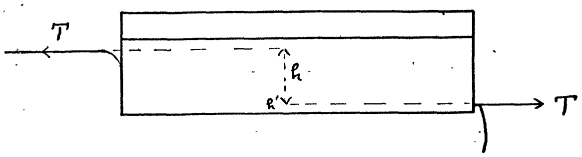

Fig. 2

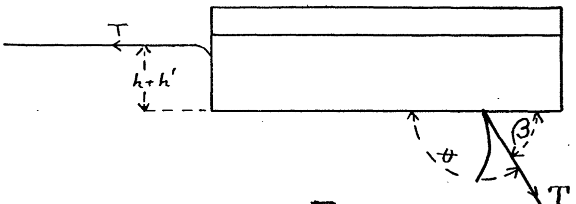

Fig. 3

$$\frac{\bar{h}^2}{2}Dg - T + T\cos\bar{\beta} = 0.$$

If the glass be pushed either way from this position the resulting change in $\bar{\beta}$ gives a resultant force that drags it back to the position of stability.

The behavior of the thin glass plates in Manley's manometer[3] seems to depend on this phenomenon.

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[1] Note that while $\theta + \beta = 180°$ here, β but not θ changes in the last case considered below.

[2] See Poynting and Thomson, "A Text-Book of Physics. (*Properties of Matter*)," Chap. xiv, p. 153.

[3] *Proc. Phys. Soc.*, London, Vol. xl, p. 178, June, 1928.