whence it fell abruptly to a nearly constant value of about 30 per cent.

These interesting results, of course, must be confirmed and extended by further observations. As many ocean stations as possible should be established and connected with land stations by wireless telegraphy. In view of the cost, such stations are not likely soon to be too numerous.

Regular observations on the Lake of Constance are, however, assured. Prof. Hergesell continues his experiments there on the days fixed upon for simultaneous international observations (usually the first Thursday of each month), and at his instigation the local and imperial governments have agreed to take up and extend the work.

But observations at sea are more important, and it is gratifying to note that the Hamburg-American and North German Lloyd companies have consented to permit kite observations to be taken, in future, aboard their vessels. A Spanish transatlantic line is said to have given similar permission. It is impossible to predict the result of the extension of such observations over the ocean, but it seems certain that the basis of weather "probabilities" would be vastly improved thereby.

WILL "LIGHTWOOD" DISPLACE THE LONG-LEAF PINE IN TURPENTINE DISTILLATION?

BY THOMAS ARTHUR SMOOT.

The days of the prestige of the long-leaf pine are gone. Time was when it was king in the South. Our geographies used to tell of the supremacy of North Carolina in the production of naval stores, whence came the name, "Tar Heel State." The schoolboy was proud of the distinction, and little dreamed that only the appellation of his State would remain, while the pre-eminence for the products would soon be claimed by more southerly States in rapid succession. But such was the case. Not many years passed before South Carolina was first, then followed Georgia, while Florida is now chief in the production of "tar, pitch, and turpentine," though the yearly output in Alabama, Louisiana, and Mississippi is large. Along with this receding line of the virgin long-leaf, rapidly drawing in about the Gulf of Mexico, the turpentine worker, with his squad of negro employes, is intimately linked. First he had his headquarters in Wilmington, then Charleston, later Savannah, while now his billheads bear the mark of Jacksonville. He has made money, this migratory man of the pine forests, but now he shakes his head sadly, saying, "It'll all soon be gone," referring to the rosin upon which he is so dependent. The passing of this great industry, with its little army of hardy toilers, reminds us of the sad vanishing of the Indian tribes before the whites. The turpentine workers left behind them the blazed forests, whitening unto their death. Many died from being so unmercifully drained of their sap, others fell by the woodman's ax, all, in one way or another, melted away. Great areas of timbered lands have been bought up by the corporations, until now no considerable amount of pine forest remains in individual hands. These forests of timber have been, or are now being, literally mowed down by the woodman, and not many years after the turpentine man has been stopped by the Gulf, the lumberman will be compelled to lay down his ax and saw on the same shores.

What will the next generation do for lumber with which to build their houses? It does look as though some steps ought to be taken to protect our descendants against a timber famine. Selfishly speaking, they will have to do as we have done—shift for themselves, and adjust themselves to such conditions as confront them. We, who are using the lumber from sapped trees now, are building houses that our fathers would have considered scarcely worth putting up. They used nothing but the best heart lumber, from the pure virgin pine. All is changed to-day, and the builder of a house is glad to get any sort of material, the white-streaked and knotty sorts being the order of the day. But when even the drained and exhausted long-leaf of to-day is gone, what? Why, the people will have to use the short-leaf, which will always abound in the Southern States. All that it requires, to be abundant, is to let it alone. Throw out an old field as worthless for farming purposes, and in twenty-five years you will have a short-leaf pine forest, which will make some kind of lumber. It will be white and soft and knotty, but our descendants will by that time have discovered paints and other preservatives that will protect it, so that the world will go merrily on, in blissful ignorance of the stately, handsome, and more desirable long-leaf that once was.

The resinous products of the long-leaf pine, however, are what the outside world has been most interested in, and has most needed and used. Tar, pitch, and turpentine are necessary to the commercial world. Whence can these necessities be supplied, when the trees that now furnish them are gone? The answer is, from the very stumps of the pine trees that once flourished, and from the lightwood knots and fat pine trunks that lie strewn all over the pine forests, or the areas where once the forests grew. This lightwood will keep for an indefinite length of time, and as long as it lasts, the needs of the world for the commodities under discussion will be supplied. Throughout the Southern States, there is just springing up a new and most interesting industry—that of the extraction of the resinous substances from this lightwood. Being in its incipiency, the industry has not yet gotten the full confidence of the public, nor has it been developed to that state of perfection to which it will be brought with a few years of experience.

The old process of making turpentine is well known, consisting in placing the crude rosin in a copper retort and evaporating it by slow fires. The vapors thus produced, when collected in the condenser, form the pure commercial spirits turpentine, while tar and other valuable by-products are found in the residue. The new process of extracting these products from the lightwood itself consists in putting the wood, say two cords at a time, into a great iron retort, into which open several steam pipes. The steam is then injected into the retort, where, kept under a temperature of from 200 to 212 degrees, the fat pine gradually yields its resinous contents. These are all collected in a condenser, just as the vapors in the ordinary still. But the result is a heterogeneous mass, containing turpentine, tar, and the numerous by-products. In order to get the separate products, this whole mass is now placed in a copper retort, similar to that used in distilling the pure rosin, and is evaporated in like manner to it. The final products are wood spirits, turpentine, tar, and by-products almost too numerous to mention. These by-products deserve special notice. Several of them, the most abundant in quantity, are utilized in mixing certain paints, in which there is no danger of marring the colors. A number of others are being used for medicinal purposes. The great difficulty in their use lies, not in the production of them, for it is well known that this hydrocarbon series may be carried on to an almost unlimited extent; but it is in their unstable nature that the trouble rests. What they are to-day, they may not be to-morrow. Notwithstanding this instability, they are being tightly bottled to prevent as far as possible their breaking up, and are being sold in considerable quantities by some factories. Furthermore, the most skilled chemists are constantly working toward methods of increasing their stability.

It is quite natural that the introduction of the new by-products should be met with opposition. The turpentine was first attacked because of its yellow color. The lightwood factory's chemist immediately went to work and discovered a means of making it clear. Next, it was claimed that the turpentine was little more than wood alcohol, but that idea was successfully routed. The present ground of attack is upon the asserted inferior specific gravity of the wood spirits turpentine, and this claim is now being vigorously assailed by the opposition.

RADIO-ACTIVE MINERALS.

Among the principal radio-active minerals may be mentioned thorite and orangite. Both of them have been examined by M. Curie. These two minerals are analogous as regards their chemical composition, but they are distinguished from each other by their exterior aspect and the different amounts of thorium which they contain. As to thorite, it is a hydrated silicate of thorium which contains about 60 per cent of oxide accompanied by a great number of bodies, among which are oxides of iron, manganese, calcium, uranium, magnesium, and lead, with potassium and sodium compounds and stannic acid. This mineral is obtained principally in the neighborhood of Brevig, Norway. In the natural state the thorite is found in the form of amorphous masses whose color varies from chestnut brown to blackish brown. It is found but rarely in the crystallized state; in this case it occurs in dodecahedral crystals. In general the thorite which occurs in Norway has a resinous luster and a conchoidal fracture. When reduced to thin plates it is translucent and sometimes even transparent. Its density varies from 4.6 to 4.8 and its hardness is 4.5. The main characteristics which enable it to be distinguished are in the first place its color, then its density and hardness. Some additional tests are also needed. When heated, it gives off water vapor. On treating with hydrochloric acid it is attacked, and forms a jelly-like mass. Sulphuric acid dissolves it when hot, even after calcination. It is only fused with difficulty by the blowpipe. When melted in a borax drop at the end of a platinum wire it gives an orange-yellow mass which becomes grayish upon cooling. A little nitrate of potash added to the melted drop allows the orange tint to remain even after cooling. It is in one of the specimens found at Brevig that Berzelius discovered thorium in 1828. Mme. Curie examined a great number of specimens of thorite. The following figures show the radio-activities of these different specimens, taking metallic uranium as unity. Uranium, 1.0; thorite from Lovo, Sweden, 0.58; different thorites, 0.04, 0.13, 0.57, 0.62. These determinations were made with an electrometer method which is very precise. It consists in measuring the current which passes in a condenser formed of two plates, on the lower of which is placed the test substance.

The second mineral, orangite, is a variety of thorite. It always accompanies the latter, and it is also found at Brevig, Norway. However, its color is different. It is either orange-yellow or orange-brown. Its proportion of oxide of thorium varies from 70 to 75 per cent. Its density is 5.4. The distinctive characteristics of this mineral are the same as for thorite. As the mineral is richer in thorium it is also more active, and some samples which were found showed a relatively high activity. The result of a certain number of measurements, taking uranium as unity, gives the values 0.87, 0.68, 0.99, and 1.10.

SCIENCE NOTES.

The annual report of the Paris Observatory for 1903 deals with a number of researches of special interest. The seventh section of the Atlas of the Moon has appeared, containing seven plates which seem the most successful yet issued, and in some respects to show a considerable advance over the best views of the moon obtained by the eye at the telescope. With respect to the Astrographic Chart, eleven plates have been passed as satisfactory, and thirty-five charts containing the triple images of 47,300 stars have been distributed. It is hoped that the second volume of the Photographic Catalogue will appear by the end of the current year. The determination of the solar parallax from the photographic observations of Eros is advancing toward completion. Of standard stars 1,661 meridian observations have been made, and 10,858 photographic observations of comparison stars, of standard stars, and of stars near the path of Eros. Three important researches based upon new methods are included in the programme for the future work of the observatory: the first relates to the determination of latitude and of its variations; the second is for the precise determination of the constant of aberration, two portions of the sky, distant 90 deg., being presented in the field of the instrument at the same moment by means of a double mirror; and the third relates to the employment of M. Lippmann's photographic object-glass in meridian observations.

Messrs. Charabot and Herbert give an account of their researches upon the successive states of vegetable matter in a paper recently presented to the Académie des Sciences. In studying the distribution of the odoriferous components in the mandarine and the bitter orange, Charabot and Lalone previously observed that the essence contained in the stem is less soluble than that which the leaf contains, especially in the case of the older growths. These conditions of relative solubility in which the odoriferous matter is found in the different parts of the plant may hold good only for such products, or these conditions, on the other hand, might be a general rule for the distribution of vegetable matter. This is the question which the experimenters set themselves to solve in the present case. Their researches, made by special operative methods, bore upon the basilic (*Ocymum basilicum*) the mandarine (*Citrus madurensis*) and the bitter orange (*Citrus bigardia*). They showed that if the organs are sufficiently developed, it is the leaf which has the greater proportion of soluble matter, both organic and mineral. On the contrary the proportion of these matters is a minimum in the root. In general, during the development of an organ the proportion of soluble substance is lowered, but it does not seem to vary to a great extent in the leaf, where it continues to predominate in a constantly increasing degree. The authors reach the conclusion that the difference in solubility between the leaf and stem matter is of the same order and varies in the same way as the difference in solubility between the essences extracted from each, according to Charabot and Lalone. The root and stem are formed of less soluble matter. In the leaf the solubility of the organic substances considered, as well as of the total matter, does not undergo any great variation, after a certain epoch of growth. In the case of the leaf, it is no doubt the phenomenon of assimilation which keeps the equilibrium as regards the organic matter. When a given substance changes in character and becomes insoluble or else leaves the leaf to enter another organ of the plant, this same substance re-appears on account of a continuous chlorophyllian work. In the stem it seems that the diminution of the solubility of the organic matter is due to the formation of less soluble compounds or a migration of soluble compounds toward organs which are in process of formation, especially in the case of inflorescence, where a specially important work goes on. To the observation that the soluble matter is less in the stem than in the leaf must be added the fact that the proportion of water in the former undergoes a greater diminution than in the latter, between the two periods of growth we are considering. The osmotic pressure would tend to increase in the stem and thus cause an exodus of soluble matter toward the inflorescence, which has a large proportion of water.