open-bonded silicates. Animal and vegetable oils, fats and juices containing hydroxyl groups are freed from color by charcoal or weakly basic silicates.

An adsorption filter of the silicate or hydrous oxide (Fe, Al) type normally has terminal H and OH in place and in that condition will adsorb bases for which its attraction is stronger than for these groups. Heating to about 200° C. drives off most of the H and OH as water and leaves the filter capable of adsorbing even weak free bases.[1] Certain pure quartz oil sands are known (Tensleep, Oregon Basin, Wyoming) having a thick brown adsorbed coating which can not be washed off. Oxidation with chromic acid leaves a pure white quartz crystal. The coating is about 0.7 micron thick. It will readsorb on soaking the cleaned sand over night in the heavy crude from that field.

These Tensleep quartz grains must then have been chemically activated by natural processes. What these processes are is well worth knowing from either a geological or commercial standpoint. A laboratory study soon showed that the activation of even crystalline quartz is neither difficult nor complicated. A sea sand may be given the adsorbing properties of the Tensleep very readily.

The plan was to attack the surface of the quartz with a strong alkali, forming a layer of alkali silicate over the surface, replace the base by hydrogen by means of an acid treatment, then drive off the H and OH by heating, leaving open bonds. KOH solutions would doubtless serve for the first step but are too slow. A bath of fused sodium or potassium carbonate (at 850° C.) is too violent, but fused potassium hydroxide (at 350° C.) worked very well, and did not crack even crystals of considerable size. A minute or two was sufficient time. Boiling in HCl, followed by thorough washing and drying completed the activation. The test was to soak in heavy crude over night. Fine sand and clay was tested by percolation through two inches of sand in a tube.

Since the object of the chemical treatment is to open up the SiO_2 bonds over the surface, it should be possible to dispense with the initial alkali treatment. Quartz or sea sand given a brief bath of hydrofluoric acid were found to be activated just as well as when given the alkali and HCl treatment.

It is hoped that these simple experiments may throw additional light on the still obscure mechanism of surface reactions and selective adsorption. Activated surfaces of pure quartz are excellent filters per unit area and their filtering action is pure chemical.

P. G. Nutting

U. S. Geological Survey

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[1] P. G. Nutting, *Economic Geology*, May, 1926, and November, 1928.

A CELESTIAL SEARCHLIGHT

A narrow beam of light, suggestive of a searchlight beam, stretched across the sky from west to east, approximately through the zenith, the evening of August 21, 1930. The point of observation was 3.5 miles north of the center of Littleton, New Hampshire, and the time, 9:50 to 10:15 P. M., E. S. T. For the first 15 minutes the beam appeared brightly over the western horizon, which was 20° above a horizontal, passed through the zenith and faded in cirro-stratus clouds about 20° above the eastern horizon. During the last ten minutes the beam was distinctly south of the zenith and during the last five faded rapidly and broadened till it was scarcely noticeable. Rough angular measurements showed that the beam was about 5° wide and that it was moving southward about 10° in 10 minutes. Vega was the center of the beam about 9:57 P. M.; at the northern margin at 10:00, and from more than 5° at 10:07 to 10° from it at 10:10 P. M. There was a general auroral glow in the northern sky during this beam phenomenon, and at 10 there was a temporary appearance of an auroral streamer in the N x E. The color of the lights was the usual auroral pale greenish yellow.

A beam of the same sort was observed by the writer two or three years ago at Silver Lake, New Hampshire. It seems that these beams may be narrow auroral arches that lose their arch-like appearance and become like straight beams when overhead.

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A SURFACE TENSION EFFECT

During the course of a microscopic investigation of certain oil products, great difficulty was experienced in deciding whether or not certain small spherical appearances were air bubbles. The optical behavior of these particles (diffraction rings, refractive shadows, etc.) closely resembled the appearance of air bubbles but were not quite identical. For use in direct comparison, air bubbles of about the same size were made by violent agitation of Nujol with air. A small portion of this Nujol containing bubbles ranging from 3 μ to about 5 μ was mounted under a standard cover-glass (.18 mm thick) and studied by different illuminations with a 6 mm objective and 20 × eyepiece.

While one of the smaller of these bubbles was being studied it disappeared between observations. After looking for it in some other portion of the field and not finding it, it was considered probable that its disappearance was the culmination of surface tension action. Another small bubble was picked out and carefully watched. At a diameter of about 5 μ its shrinkage became rapid enough to be measurable with the filar micrometer from minute to minute. This rate of shrinkage increased, apparently as a parabolic function of diameter. At about 3 μ it became rapid enough to be followed by continuous observation. At about 1½ μ one side of the bubble seemed to collapse and the bubble instantly disappeared. The duration of the collapse and disappearance seemed to be from about 1/5 to 2/5 seconds. This observation was repeated again and again, starting with bubbles about 4 μ to 6 μ, and the same phenomena were always observed.

Calculation from the surface tension of the Nujol (assumed as 44 dynes) indicates that if the ordinary surface tension values hold for bubbles of this diameter (as is probably the case) the pressure within the bubbles rises to a value of about 8 pounds per square inch above atmosphere, when the bubble begins to show continuously observable shrinking, and rises to about 16 pounds above atmosphere at the time of collapse.

Believing that the resulting increase in the amount of air thus forced into solution should be reflected in the behavior of larger bubbles, the diameters of the larger bubbles were carefully observed with the filar micrometer, and they did, in fact, show growth, although it was so slight that it would not have been noticed without careful measurement. The effect has not been studied either with other gases or with other liquids such as aqueous solutions, but there seems to be little reason to expect any differences except those of degree.

The primary purpose of the experiment was excellently served. In the microscopic preparation being studied, the rounded particles suspected of being air bubbles varied from about ½ μ to about 5 μ and the various sizes frequently occurred in close proximity to one another. It was, therefore, possible to say positively that the rounded particles could not possibly have been air bubbles because the experiment proved that bubbles less than about 3 μ diameter could not be stable in such liquids. The larger bubbles grow and the smaller vanish by loss of gas to the liquid and thence to larger bubbles or to any exposed surface.

So far as known, this effect has not been previously observed and recorded. Once considered, however, it should obviously be expected, although a number of scientists to whom it was mentioned have at first doubted its possibility. Attention is called to it because it may provide a method for studying the degree to which normal surface tension laws continue to hold true for highly curved surfaces and also because this effect explains many phenomena not hitherto made wholly clear. It sheds light on the ready clarification of sirups, lacquers and other highly viscous solutions in which minute bubbles could not be expected to reach the surface in any reasonable length of time. It indicates a contributory factor in mineral froth flotation by mechanical agitation. It serves to explain the ease with which liquids may be highly supersaturated with gases and certain apparently anomalous phenomena observed in the absorption of gases in towers, tanks, tourilles, etc. It gives a clearer understanding of the sudden and violent "bumping" of superheated liquids.

It may even be found to have a physiological bearing on the condition of dissolved gases in the blood stream, and the consequences of marked changes in pressure, as in aviation.

Wm. M. Grosvenor

COLLEGE TRAINING FOR THE FISHERIES

All successful men have an education. Some get it without going to school and some get it after going to school. Yet the college education may be a very helpful step-ladder to success. As to the kinds of trained required for success in the fisheries field there is much confusion of thought. This is due to the lack of a proper analysis of the various branches of the fisheries into which one may embark. The biologist thinks largely in terms of biology, the technologist in terms of chemistry, physics and engineering, and so on ad hominem. Few have really analyzed the fisheries field in its entirety, breaking it down into fundamental lines of equal rank but quite different in the character of training required. This discussion is written with the hope of clarifying the situation and aiding students to map out educational courses with definite objectives in view after graduation.

Before actually outlining these fields, first let us break down the prospective personnel into three groups of persons: (1) Those bent on becoming highly trained key men in their respective fields; (2) those of good education or wide experience upon whom the first group must largely depend for the carrying through of their particular program; (3) those with limited capabilities for advancement either through lack of training or for other reasons.

In this age of specialization the key men must be highly trained, each in a particular field. What are these specialized fisheries fields and what classes of positions are open? These are four in number—fisheries biology, economics, technology and administration. Having selected one of these fields, the prospective fishery expert will not dissipate his efforts on various courses in any of the other three fields, but will center his undergraduate studies on one par-