and per cent of calcite determined. (2) Sample treated by decantation to remove mud and silt and again weighed. (3) Sand residue treated with Thoulet's solution (sp. gr. 2.95) and the heavy minerals were thus concentrated. (4) Magnetic treatment of the heavy residue separated out the magnetite. (5) The light and heavy concentrates were studied with the binocular and petrographic microscopes, and the mineral species were determined by measuring their refractive indices by means of a series of liquids of known refraction.

SODIUM CARBONATE MINERALS OF THE MOGADI LAKES, BRITISH EAST AFRICA

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Taking the train from Mombassa, the main port of British East Africa, to Nairobi, and traveling southwestward, one comes to the interesting Mogadi Lake. Tho called a lake, it is in reality only a deep valley filled with the sodium sesquicarbonate mineral, trona. During the rainy season water may collect there to a depth of about 30 cm., but wearing rubber boots one can cross the "lake" easily. In the dry season, which lasts more than three fourths of the year, the whole area, except at the extreme north end where a stream enters, is a porous mass of the crystalline mineral. This "lake" occupies a deep valley, running north and south, about 35 kilometers (22 miles) long but not more than 3 km. (2 miles) broad.

The Mogadi trona deposit consists of an aggregate of bladed columnar monoclinic crystals. Near the shore these reach a length of 8 or 9 cm., but further out they decrease to 5 cm. Their color is pale yellow, but on top there is often a crust of smaller crystals showing a brilliant red. The deposit shows alternating layers of large and small, and of clean and impure, crystalline material. An analysis of an average sample of specific gravity 2.14 gave: Na_2CO_3 43.55, $NaHCO_3$ 40.41, H_2O 15.55, NaCl 0.36, $Fe_2O_3+Al_2O_3$ 0.04, SiO_2 0.07, CaO, MgO and SO_3 traces, sum 99.98%. This establishes the formula as that of the sesquicarbonate mineral trona, $Na_2CO_3 . NaHCO_3 . 2H_2O$, and, as the other constituents are present for the most part in obvious mechanical admixture, the deposit is essentially a pure mass of this material.

The trona crystals are not affected by the atmosphere, but the red tint of the top layer bleaches out in sunlight. The colored constituent, which is present in very small amount, can be extracted from a solution of the red crust by shaking with ether. In the writer's opinion this red tint is due to admixture of the coloring matter from flamingo feathers. Large flocks of these birds can be seen in the northern end of the valley catching a small fish which, remarkable as it may seem, can live in the rather concentrated soda solution.

As to origin, it appears as if a sodium silicate rock must have been decomposed by the action of water and carbon dioxide. This is indicated, first, by the presence of extensive bands of flinty silica in the rocks near the "lake" and, further, by the escape of carbon dioxide from numerous cracks in the rocks. Had there been decomposition of sodium sulfate by limestone, for instance, there would be present large quantities of gypsum; or if the carbonate was magnesite, then epsomite would have been formed. There is, however, no gypsum or epsomite either in or near the "lake." If sodium sulfate had been decomposed by organic matter, such as fish, there would have been formed hydrogen sulfide, free sulfur or sulfide minerals, yet there is no trace of any of these in the district. Moreover, there is no evident source for the large body of original sodium sulfate which would be called for in such an explanation.

About 40 km. (25 miles) south of the Mogadi Lake lies the Little Mogadi. This is a shallow dry salt pan about 2 to 3 km. in diameter. The salt crusts found there are yellowish gray in color, and consist of bladed crystals also suggesting the monoclinic system. They are 2 to 3 cm. thick, and so hard as to emit when struck with a key a clear ringing sound. Analyses of two specimens collected there indicated the composition to be that of pure sodium bicarbonate, with only traces of organic impurities. It is commonly supposed, and specifically stated by Doelter in his Handbuch der Mineral Chemie, that sodium bicarbonate can not exist in nature, and that if it ever forms it changes promptly in contact with the air to trona, by the loss of part of its CO_2. However, it should be noted that the Little Mogadi is situated in the same depression as is the Mogadi Lake above described, and has probably been formed in some past geological time by an overflow from the larger "lake." The trona then deposited was exposed to the action of a large excess of carbon dioxide, which gas is continually being given off from the cracks in the soil and rock with a hissing sound. As a result, sodium bicarbonate could readily form according to the reaction: $Na_2CO_3.NaHCO_3.2H_2O+CO_2=3NaHCO_3+H_2O$. The continued action of carbon dioxide would then prevent the decomposition of this compound back into trona.

The writer at first thought of naming sodium bicarbonate, here recognized as a mineral, after the locality. But on submitting a preliminary draft of this paper to Dr. Edgar T. Wherry, at that time Editor of THE AMERICAN MINERALOGIST, the latter recommended that no new name be given unless the nature of the material could be confirmed optically. Two small samples of the material collected were accordingly sent to Dr. Wherry; unfortunately they had been greatly delayed on the way from England to this country, and had become moist while standing for 6 weeks in the custom house. It was feared that they might be more or less decomposed. This proved to be the case, for Dr. Wherry reports as follows:

"It is easy to distinguish trona from sodium bicarbonate optically, for the latter has one refractive index as low as 1.380, practically matching the immersion liquid methyl-ethyl ketone, whereas trona has as its lowest index 1.410. The double refraction of the bicarbonate is also almost twice as great as that of the sesquicarbonate, so that they look somewhat different between crossed nicols. Moreover, the crystals of trona, being elongated on axis *b*, show parallel extinction. Sample 'B' consists of clear-cut blades a centimeter long, and has in every respect the typical optical characters of trona. Sample 'A,' on the other hand, is not uniform in structure. There are small crystalline rods, obviously of trona, scattered thru it, but also some minutely crystalline, efflorescent particles. I was unable to find in the latter material any crystals which had an index lower than the lowest of trona, but it is possible that it may represent a pseudomorph of trona after sodium bicarbonate. However, in view of the impossibility of obtaining definite optical data on the original unaltered material, it is urged that the introduction of a new mineral name for sodium bicarbonate be avoided for the present."

In conclusion, I wish to acknowledge the aid of Mr. Arthur Trowbridge of Felling on Tyne, Northumberland, England, the first European to visit the deposits, and obtain data on this interesting locality. Mr. Trowbridge's report as to the feasibility of commercializing these deposits has led to active operations for transforming the material into soda ash of high quality.