These arguments might be expanded indefinitely, but the purpose of the present paper is to call attention to a great opportunity in the hope that many other writers will offer suggestions out of which the real solution will come. Until the time when some capable organization can take charge of the work, correspondence through the scientific journals might accomplish much, or the present writer will welcome private correspondence which he will undertake to arrange and turn over to whatever organization may prove suitable.

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ARE BATHOLITES UP-BULGES OF SIAL?

THE able report to the National Research Council by F. F. Grout and a discussion in Washington recently have revived in my mind a question that has been there a long time. Are the granite batholiths up-bulges of the sial layer some ten kilometers thick of which the earthquake waves have informed us, or are they intrusions of more modest dimensions—phacolites, perhaps, such as are suggested by the work of Balk and Buddington[1] in the Adirondacks? Does the coarseness of their grain throw any light?

In the theory of the coarseness of grain as affected by the rate of diffusion (of heat or mineralizers) which I developed in 1894–1896[2] which is abstracted in Fairbanks' recent book[3] I found that there should theoretically be a central belt of uniform cooling and grain, in which the size of grain did not vary with the distance from the margin. For the grain I obtained a formula:

$$E = \frac{kc}{\pi a \sqrt{u}}$$

That is, the average linear dimension of the grains (E) increases proportionally to the "power of crystallization," which depends on the composition, etc. (k), and to the linear scale of the phenomena, *e.g.*, the thickness of an intrusive sheet and its contact zone (c), but decreases with the square root of the diffusivity (a^2) and the difference between the conditions (temperature) at which crystallization takes place and those of the country rock (u). The initial conditions of the magma are not a factor! They may be much hotter.

In small aplite dikes the grain is fine because (c) is small. But in the pegmatites we may find extremely coarse grain which I take to be because (u) is small. That is, the country rock is hot and the magma is full of mineralizing juice so that the crystallization temperature is low.

But so far as my experience goes, and that of such friends as Larsen and Laforge, in a normal even grained hypidiomorphic batholite of granite there is a rather narrow range of grain, say from 0.2 cm to 2 cm, usually about 0.8 cm. From the character of the quartz we know that (u) is less than 825° C. and probably is about 400° or possibly may get down to 200°. Its square root is then 20 ±. The square root of the diffusivity is about 0.07. From certain cases where the size of the granite dike or boss may be inferred I judge that is something like antilog -5 ± 1, which is quite a range to be sure, but puts limits to (c). For a normal anchieutectic granite (using Vogt's term) k can not vary enormously except with the mineralizing water present, an increase of which will tend to lower (u) and also the viscosity, in other words increase (k). Thus the limit in the coarseness of their grain (hypidiomorphic and not protoclastic) would seem to put a definite limit to the depth and size of granite batholiths. I should like to have colleagues test the matter. The larger the granite batholiths are the greater the (c). The deeper they are the greater the country rock temperature and so the less the (u). In both cases the greater would be the grain. It looks as though the granites we see could hardly be direct up-bulges of a crystallized ten kilometer layer, as Van Hise used to urge and I would rather like to believe.

I will quote from a letter just received from Professor A. Holmes:

> My experience in Mozambique and knowledge of other areas like Finland by their literature suggest to me that batholiths can not be very deep, because no sign of them is to be found in the levels of the crust deeply denuded by long exposure and uplift. The rocks there are all gneisses veined through and through with thin granitic veins.

ALFRED C. LANE

ANOTHER CAPTURE ON THE NEW JERSEY COAST OF THE BASKING SHARK, CETORHINUS MAXIMUS

ABOUT 2 A. M., June 5, 1930, two fishermen (Carl Holgerson and Edwin Gustafson, of Monmouth Beach), in fishing their gill net about 15 miles south by east of Long Branch, found a large shark tangled up in it. The shark had so many fathoms of net rolled around it that there seemed nothing to do but tow it to shore and there after daylight salvage what they could of the net. After two hours' work they succeeded in getting a double half hitch of three-quarter-inch rope around the snout of the shark, and

[1] New York State Museum Bull. 281, 1929.

[2] *Bull. Geol. Soc. Am.*, 8: 403, etc., 1897, also 14: 394–5.

[3] "Laboratory Investigation of Ores," Chapter VI, p. 123.

from this they then ran two lines to the stern of their 23-foot Seabright skiff. With the big shark thus held fast, they towed it head-on to shore. But so heavy was the fish (estimated to weigh 1,800 to 2,000 pounds) and so violent were its struggles that it took their 16-horse-power gasoline engine two and one half hours to cover the distance. The great fish lived about an hour and three quarters after being dragged out on the beach.

Seeing that their catch was an unusually large shark (14 feet, 3 inches long between perpendiculars) of a kind unknown to them, they determined to exhibit it in order to recoup some of the loss of their net. Eviscerating the fish (a female) they filled the interior with "dry ice" and put it in a tent where it was seen by hundreds of people. Among the visitors was Mr. Morris Ranger, of New York City, who on Saturday afternoon (June 7) and again on Sunday telephoned the museum. The administrative and scientific staffs were away, but Mr. Ranger finally got in touch with Dr. W. K. Gregory, curator of fishes, at his home, and so accurately described the shark that it was apparent that it was a specimen of the basking shark.

On Monday, June 9, I went down to Long Branch and through the kindness of Mr. Ranger was taken to see the fish in a room in the freezer of the Monmouth Beach Fish Company where I found it frozen as solid as a log. It was a fine specimen in perfect condition save that the viscera including the reproductive organs were gone. This was very unfortunate, since thereby the chance was lost of getting at least some idea of the method of reproduction. The liver is said to have been very large, weighing about 135 pounds. The fish was then purchased from its captors and through the courtesy of Manager W. F. Carhart was held in the freezer until it could be sent to the museum.

About noon two days later (one week after its capture) the still frozen fish was delivered by truck at the museum. Being stiff as a log, the great shark held its shape and was much easier to handle than when thawed out the next morning. At this later time, however, we could manipulate the head and jaws better, and it was now possible to stuff the abdomen with excelsior and sew it up to make a cast and then to skin it. From the fish we got a color sketch, a number of excellent photographs (especially of the snout and mouth parts), a full set of measurements, the skin for mounting and the head with skull, jaws, gill apparatus and shoulder girdle intact together with the fins and vertebrae preserved in pickle. These will furnish material for a careful anatomical study of the hard parts—those attached to the skull being *in situ*.

Some measurements of this huge shark will be of interest. It was a female, 14 ft. 3 in. between perpendiculars. The girth at the angle of the jaws was 5 ft. 5.5 in., at the front edge of the pectoral the same, at the front edge of the first dorsal 5 ft. 2 in., around the "small" of the tail 1 ft. 10.75 in. The length of the first gill slit from top to bottom was 3 ft. 7 in. The first dorsal fin was 1 ft. 5 in. high. The vertical depth of the caudal measured 3 ft. 9 in. Width over head between eyes 1 ft. 4.5 in. Distance around curve of lower jaw 2 ft. 6 in. Vertical gape, jaws widely distended, 1 ft. 1 in. The estimated weight of the fish varied from 1,800 to 2,000 lbs.

When the skin of our fish has been mounted on a manikin modeled from the plaster cast and this checked by our measurements and photographs made of the fish in perfect condition, we will have in our Hall of Fishes in the museum an adequate representation of this great fish. A photograph of this together with the other pictures of the fish will then be used to illustrate an article on the natural history of the basking shark.

HISTORICAL ACCOUNT OF *Cetorhinus* ON THE NEW JERSEY COAST

The earliest record of the occurrence of the basking shark in these waters dates back to 1822. In that year Lesueur[1] described a male specimen captured in the autumn of 1821 near Brown's Point, Raritan Bay. Although the skin had been mutilated by harpoons and bullets in the process of capture, and was further damaged in detaching it from the body, it was exhibited by the fishermen under the name of "Leviathan or Wonderful Sea Serpent" in order to get money to replace their net. The poorly mounted fish is thus described by Lesueur:

> It was, however, at length, extended upon a frame, which imitated the form of the animal, though the attitude is forced, the branchial openings too widely extended, the head too much elevated, and the mouth so much expanded as to admit a man in a sitting posture. Notwithstanding these inaccuracies however, much credit is due to the individual who prepared this skin, as it presents a good idea of the form and magnitude of this elephant shark.

However, from this mount, if such it may be called, Lesueur wrote a very accurate description and his illustration is one of the best known to me. His figures for the size of this first New Jersey specimen are: "Total length, when recent 32 feet 10 inches,

[1] C. A. Lesueur, "Description of a Squalus, of Very Large Size, which was Taken on the Coast of New Jersey," *Journ. Academy Natural Sciences Philadelphia*, 2 (pt. 2): 343–352, plate, 1822.

circumference 18 feet—of the dried skin 22 feet, and 9 feet 7 inches and 4 lines in circumference." The figures of our specimen have been set out above. Those for the girth are only approximate since the fish had been eviscerated.

The next known reference to *Cetorhinus* in New Jersey waters is a very indefinite one by Charles C. Abbott.[2] He says:

> *Cetorhinus maximus*, Basking Shark. Occasionally in August and September, a specimen of this species is seen, but they are seldom captured. They are a northern species that are seen on our coast only as stragglers.

Fowler in his extensive work[3] on New Jersey fishes says: "This very rare giant shark, which is apparently unknown to most fishermen, does not seem to have been noted since Lesueur's time, early in the last century." Sixteen years later, however, Fowler records[4] the capture of a 17-foot specimen on April 26 about 65 miles off Atlantic City. It was taken in a purse seine which was almost destroyed by its struggles. Still later[5] the same author writes: "Several other records on the same coast [New Jersey] were from specimens in pounds [nets] at Beach Haven and Seaside Park." In a letter, Fowler says that he has no records later than those noted above.

Since the above was written, Mr. A. R. Samson, of this city, has kindly reported the capture of a specimen of the basking shark, near Bay Head, New Jersey, on July 28, 1930. Its length was estimated at from 10 to 12 feet, and its weight at about 1,300 pounds. It was taken in a net and the fishermen report that it offered little or no resistance. I have been unable to ascertain its sex. It is being held in the freezer of the Bay Head Fisheries Company for exhibit at the New Jersey State Fair at Trenton. Photographs of this fish positively identify it as *Cetorhinus maximus*. The New York newspapers report the capture of another great shark (17 feet long) off Long Branch on August 7. This is presumably another basking shark, but in the absence of photographs one can not be sure.

Cetorhinus ON OTHER PARTS OF OUR ATLANTIC COAST

Jordan and Evermann in their "Fishes of North and Middle America"[6] say of the basking shark, "Straying south to . . . Virginia." This is repeated in their "Check List," p. 20, 1930. However, they do not give any authority for this statement. In this connection, Mr. Fowler, who has a wide knowledge of the fishes of our mid-Atlantic coast, writes, "I know of no captures on the Delaware, Maryland or Virginia coasts." Furthermore, examination of faunal lists of Virginia fishes fails to confirm the statement above. Inquiry of Dr. S. F. Hildebrand, whose studies of the fishes of the Chesapeake Bay have made him conversant with the literature, brings the information that he knows of no records of the shark in Virginia waters.

Since *Cetorhinus* is an Arctic or at any rate a sub-Arctic shark, which drifts with the south-flowing inshore cold water down along the eastern coast of the United States, it is found more abundantly north of New Jersey. Thus Hussakof[7] records a specimen 14 feet long which became entangled in a bluefish net at Westhampton Beach, Long Island. There are questionable accounts of specimens at or off Woods Hole in 1906 and 1908. However, since Cape Cod forms a veritable trap for northern fishes which drift south, this shark is more abundant in the Gulf of Maine as is to be expected.

The data for its known occurrences in the Gulf of Maine have been well worked up by Allen[8] and by Bigelow and Welsh.[9] These accounts (especially Allen's very detailed one) are worthy of careful perusal. The facts therein which are of interest just here may be summarized as follows. It has been ascertained that prior to 1820 there was a regular fishery for this great shark in the Gulf of Maine for its oil and liver. From 1828 to 1920 there are listed the captures of 12 measured specimens varying in length from 14 to 31 feet. In addition there are more or less indefinite accounts of "many others" estimated at from 25 to 35 feet in length. From these data it is plain that the specimen under consideration was only about half-grown.

As has been stated, we plan to prepare an accurate mount of our skin of *Cetorhinus* to be hung at the entrance to the Hall of Fishes. The only other mounted basking shark in the United States so far as I know is the fine 26.5-foot specimen in the Boston Society of Natural History.

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[2] C. C. Abbott, "Fishes," in his "Catalogue of Vertebrate Animals of New Jersey"; Appendix E to "Geology of New Jersey," by George G. Cook, p. 828, Newark, 1868.

[3] Henry W. Fowler, "The Fishes of New Jersey," Annual Report New Jersey State Museum, 1905, pp. 57–59, fig., Trenton, 1906.

[4] H. W. Fowler, "A Basking Shark (*Cetorhinus maximus*) off New Jersey," *Copeia*, no. 101: 89, 1921.

[5] "Basking Shark," *Fish Culturist*, 8: 30, 1929.

[6] Vol. I, p. 51, 1896.

[7] L. Hussakof, "The Capture of a Basking Shark on Long Island," *Copeia*, no. 21: 25–27, 1915.

[8] G. M. Allen, "New England Sharks in the [Boston] Society's Collection," *Bulletin Boston Society Natural History*, no. 24 (*Cetorhinus*, pp. 3–8), 1921.

[9] H. B. Bigelow and W. W. Welsh, "Fishes of the Gulf of Maine," *Bulletin U. S. Bureau Fisheries*, 40 (pt. 1), (*Cetorhinus*, pp. 41–43), 1925.