

DISCUSSION AND CORRESPONDENCE

"PETROLIFEROUS PROVINCES"

In a discussion of Petroliferous Provinces in a recent number of *Mining and Metallurgy*,¹ Dr. Charles Schuchert has quoted from an article on "Some Factors in the Geographic Distribution of Petroleum"² by the present writer, and has drawn certain conclusions and made certain inferences which are decidedly at variance with the ideas the author intended to convey. In order that some of the apparently ambiguous statements in the article on Geographic Distribution should not be generally misconstrued, it is desired to call attention to certain points which the reviewer has apparently overlooked.

Dr. Schuchert says:

Since the previous paragraph was written there appeared the suggestive paper by Mehl, already cited, in which he points out that all the major oil fields of the world are situated between 20° and 50° north latitude. Further, that there are no major oil areas within the tropics or in the southern hemisphere. As the known major oil fields lie between the present isotherms of 40° and 70° F., he thinks that this distribution "does suggest a distinctly zonal distribution of petroleum in which temperature may have been an important factor." The question that here arises is, Is this suggestion of present climatic conditions also true for the times when the oil was deposited in the strata in which it is now found, remembering that the oil fields were not made recently but are the accumulations of hydrocarbons of the seas of geologic ages? The answer is not at all in harmony with Mehl's suggestion, for we are living in an exceptional time of stressed climates and marked zonal conditions, while the mean temperature conditions during the geologic ages were warm and equable throughout most of the world, and this is even more true of the temperature of oceans than of the lands.

The paragraph that called forth this comment follows:

¹ *Bull. Amer. Inst. Mining and Metallurgical Engineers*, No. 155, pp. 3058-3070, November, 1919.

² *Bull. Scientific Laboratories, Dennison Univ.*, Vol. XIX., pp. 55-63, June, 1919.

Attention is further called to the general correspondence between the position of the twentieth and fiftieth parallels in both hemispheres with the average annual isotherms of 70° and 40° respectively. Although these parallels are, in reality, nothing more than imaginary lines of geographic references, *each does, in much probability, mark the average position of some isotherm as it has shifted in past geologic times.* While the disposition of maximum accumulations as here bounded does not indicate a definite temperature zone within which petroleum has been formed, it does suggest a distinctly zonal distribution of petroleum in which temperature may have been an important factor.

There follows a few paragraphs further on:

Very often the rapid decay of organisms is pointed to as illustrating the manner in which petroleum is formed. In certain parts of the Mediterranean Sea, for instance, the accumulation and decay of organic detritus is so rapid that the lower levels of the water are filled with scattered globules of oil. *Instead of illustrating how petroleum is formed, however, it points to the effective manner in which fatty matter is ordinarily separated out from accumulating sediments. Certainly, the globules which are escaping into the water offer no suggestion of being retrapped and converted into petroleum.* It is only that part of the organic matter which is converted into oil so slowly that the accumulating sediments form a sufficient thickness and suitable succession to retain it against the tendency of the associated waters to drive it off, that may become petroleum.

So much has been added to our knowledge of the climates of past geological ages by the work of Dr. Schuchert and others that it does not seem appropriate, in an article not intended primarily for the beginning student in geology, to call attention to the fact that the present average annual isotherms are not necessarily coincident with the same isotherms throughout past geologic periods. Furthermore, it would appear that one might logically take for granted a general knowledge of the principles underlying temperature zones and the nature of their boundary lines as follows:

1. The sinuosity of isotherms is determined largely by the extent of the land masses and their configuration.

2. In general, the more widespread the oceans the less sinuous the isotherms.

3. During periods of more nearly universal oceans, the closer the parallelism between isotherms and parallels.

It would appear that the logical conclusions to be drawn from the two immediately preceding quotations, providing we may take for granted a knowledge of the general conditions of past climates, are as follows:

1. The belt between the parallels 20° and 50° north latitude was, during the periods when the petroleum of the zone was forming, some definite temperature zone the boundaries of which, the average annual isotherms, were essentially coincident with the parallels.

2. The temperatures of this zone very likely fluctuated within a single period and showed more or less marked differences from period to period.

3. The average of the fluctuating temperatures for this zone was not necessarily the same as that of this belt for the present time, viz., 40°-70° F.

4. The only reference to the formation of petroleum in this zone at present day temperatures (the Mediterranean Sea) *does not* illustrate the manner in which petroleum is formed.

The obvious inference of these conclusions is that could we determine the exact temperature conditions under which petroleum is formed there would be available another means of testing the temperatures of the various areas in which the petroleum was formed, during the periods when it was forming. In other words, some estimate could be made of the average temperature of the "petroleum zone"—that belt bounded by the parallels 20° and 50° north latitude—during the "petroleum periods."

There is one more point on which the present writer's view was, perhaps, not adequately stated, although his intention would seem to be clear. The following is from Dr. Schuchert's criticism:

... The writer also knows that hydrocarbons have accumulated in large amounts in seas within the tropics, yet seemingly the amount is far the

greatest in what is now the north temperate zone. That this zone has the greatest amount of petroleum is apparently due wholly to the greater land masses here, along with the necessary storage strata accompanied by the proper amount of deformation.

Even if Mehl's suggestion were correct, and we should accordingly think of next exploiting the temperature region of the southern hemisphere, we must not overlook the fact that the northern hemisphere is a land hemisphere, while the southern one is a water hemisphere, and therefore has greatly reduced continents.

To quote from the article on "Geographic Distribution":

Regardless of the lack of thorough prospecting, however, there is reason to believe that of the three zones, the equatorial belt between the twentieth parallels and adjacent belts in the northern and southern hemispheres extending north and south to the fiftieth parallels, the northern belt will, when investigations are carried to completion, be found the more productive. For instance, one may safely assert that, all other factors being equal, the amount of petroleum underlying a given area is directly proportional to the size of that area. It is evident that in the area of exposed lands neither the southern nor the equatorial belts compare favorably with the northern zone.

And again, in summarizing:

If we may grant, then, that within a limited zone, the equatorial belt, conditions have been unfavorable for the formation of accumulations of petroleum, on the average, it is logical to seek a belt in the southern hemisphere suitable for such deposits, to correspond with the belt in the northern hemisphere. *Were the temperature factors alone to be considered, there is little doubt but that much might be expected from the southern zone. It has already been pointed out, however, that the area of exposed land within this zone is relatively small and of this a very large proportion consists of Pre-Cambrian or igneous rocks. Apparently little more is to be expected from the southern belt than from the equatorial zone.*

As the writer stated in the article quoted by Dr. Schuchert, it was hoped "that the speculations would call forth a discussion of the principles involved and possibly stimulate investigations in the several branches of science interested." He was much surprised to learn

that these principles had been so stated as to convey a meaning quite different from that intended. It is hoped that these notes concerning the writer's statements that have been criticized will throw a somewhat different light on their interpretation.

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AN IMPROVED METHOD OF HOLDING LARGE SPECIMENS FOR DISSECTION

MR. JOHN M. LONG¹ recently published a scheme for holding large specimens open while dissecting them in which he uses "trays of galvanized iron with four or more loops of metal soldered on the sides to which ordinary heavy rubber bands are attached. To these rubber bands are tied small fishhooks which have had their barbs filed off. These hooks are to be fastened to any part of the anatomy so as to hold the specimen firmly, or to pull certain parts to the desired position." As these rubber bands with the sharp fishhooks attached are permanently tied to the sides of the trays, there is some danger and inconvenience in handling the latter. This difficulty can be overcome and the whole scheme improved upon by fastening small, blunt hooks to the rubber bands at the opposite ends from the fishhooks, thus making them so that they can be easily removed from the trays. It is also a good idea to file the points of the fishhooks down somewhat so that they are not so dangerous to handle, and yet they can be easily thrust through the skin or flesh of the specimen to be held.

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SCIENTIFIC BOOKS

South. The Story of Shackleton's Last Expedition, 1914-1917. By SIR ERNEST SHACKLETON, C.V.O. With 88 illustrations and diagrams. The Macmillan Company, New York, 1920. \$6.00.

It has been well said that peace has its

¹ SCIENCE, Vol. XLIX., pp. 120-121.

victories as great as those of war. Too much praise can not be given the men who for country alone, or for the whole world, have struggled and suffered, bled or died. But peace, not war, is the normal phase of our life, and its unwarlike victories—material, mental and spiritual—most deeply affect us. For this reason the world delights to read this straightforward tale of Shackleton, wherein are embodied high adventure, unique experiences and thrilling situations with displays of courage and persistence, of fidelity and solidarity—qualities which ennoble mankind.

The scientific work in view was the most comprehensive and ambitious ever attempted by a polar expedition. In extent and importance it approached, if it did not surpass, the International Polar Conference program of 1881-1884. Geographically the vast ice-clad continent of Antarctica was to be crossed from Weddell Sea to Ross Sea, and its glacier-lined, unknown coasts charted by cruises in unvisited waters of the Antarctic Ocean. Scientifically were to be studied the fauna of the sea, the hydrography of the ocean, the geology of the land, the meteorology of the air, and the mysteries of magnetism. The primary base, under Shackleton personally, was to be established near Vachsel Bay, Luitpold Land, discovered in Weddell Sea by Filchner in 1912.

It is of special interest that this south-polar area, through the comprehensive policy and timely application of England's colonial methods, is a part of her empire. By proclamation of July, 1908, this region was declared to be British territory which was defined as "Situated in the South Atlantic Ocean to the south of the 50th parallel of south latitude and lying between 20 degrees and 80 degrees west longitude."

The second party—to enter Ross Sea—will be later considered. Sailing from Plymouth, August 8, 1914, after the Admiralty had declined the offer for war purposes of his ship *Endurance*, Shackleton made his final arrangements at Grytvikin, South Georgia whence he steamed south on December 5. His ship was fitted for every contingency, and his crew