Industrial Micropaleontology

Microfossils revolutionised oil extraction

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"BUG-MEN" Lead Hunt for BLACK GOLD

Searching for Oil With A Microscope

Samples Containing "Bugs" Being Boiled with Acids to Loosen the Tiny Fossilized Shellfish for Microscopic Examination

TINY bugs, dead millions of years, recently led to the discovery of a great California oil field, whose millions of barrels of sticky "black gold" brought sudden wealth to many producers. These tiny fossil bugs are today locating new sands far below the producing levels of nearly dead fields. They infallibly tell drillers when to set casing, when to abandon hopeless drilling projects and when to spend thousands of dollars more to reach their goal.

In years past, several dry wildcat wells were drilled near Venice, Calif., but not until oil men applied the newly developed science of micro-paleontology to the old samples of shale and sand from these "dusters," was there definite promise of an oil structure.

Locating the oil structure is the greatest problem in prospecting for oil. Level fields or lofty mountains may cover buried hills and valleys. The layers of which the earth's crust is composed have been lifted, twisted, and folded by the earthquakes and convulsions that have occurred since these strata were deposited on ocean beds in long forgotten ages. When these layers are arranged so that they form a subterranean hill, or anticline, the prospect of oil is favorable.

Although many methods of mapping this underground topography have been devised, the one used by "Duke" Curtice, a Los Angeles oil operator, in the discovery of the Venice field is not only the newest but perhaps the most effective. Micropaleontology, or "bug hunting," depends on the fact that in each layer of the ground certain kinds of bugs predominate. These bugs, the fossilized remains of microscopic shellfish, may be identified and

370

Above, Geologist Studying Walls of Excavation to Find Types of "Bugs" Predominating; Below, Magnified Bugs

their types traced to determine the underground structure.

"We were making a subsurface contour map of the whole Los Angeles basin," said Mr. Curtice, "when it became apparent that there was a strong likelihood of an oil structure on the west side of the basin. Immediately we redoubled our efforts in this locality. From hundreds of outcrop and well samples, we picked thousands of bugs, examined them under the microscope and classified them. Correlation of the findings from several oil wells, together with what little surface information we could get, gave us a fair, but not a complete, picture of the subsurface conditions.

"On the basis of the information we had, we estimated the location of the structure, leased 850 acres and drilled a test well. Although we went to about 7,000 feet, we did not strike oil. We were 'off the structure.'

"But we were not disappointed," the oil man continued. "During the drilling of the first well, we took a great many core samples. From these we were able to obtain enough information to complete our picture.

371

An article in the March 1932 issue of Popular Mechanics *magazine, titled "'Bug-Men' lead hunt for Black Gold: Searching for oil with a microscope", introducing the work of industrial micropaleontologists to a broad audience.1*

The discovery that allowed to overcome the micropaleontological dead ends and launched the success of this field of studies was to come from an unexpected field of research: petroleum geosciences. Since the beginning of the 20th century, the use of fossil fuels had been growing exponentially. This was due to the success of the internal combustion engine, developments in transport, and oil's significant advantages over coal and steam (being lighter, easier to transport, and cheaper, with a better calorific value). Yet, at the beginning of the 20th century, the methods for prospecting for oil were still rudimental and could not keep up with the increasing demand. To overcome this problem, oil companies had already been employing geologists since the end of the 19th century. It was geologists who had successfully mobilised the so-called anticlinal theory to discover new wells: as petroleum and natural gas migrate to the most elevated portions of permeable beds they can usually be found in anticlines. But after the first World War, faced with ever-growing demand, oil companies started exploring regions with more complex stratigraphies that presented obstacles to geologists – like the Gulf of Mexico. Seeking a solution to their geological problems, the

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extractive industries hired paleontologists hoping that they could help geologists trace oil fields more effectively. However, microfossils had been effectively declared useless for these types of problems, because of their assumed long evolutionary ranges. Instead, early researchers focused on macrofossils to resolve these stratigraphical issues – with poor results.

That is, until a consortium of US oil companies, which had moved to the Gulf coast after the privatisation of Californian oil lands, hired three young women just out of college to work on their collection of fossils: Esther Applin,[2] Alva Ellisor, and Hedwig Kniker. These three scientists were the first to identify the importance of (Foraminifera) microfossils in correlating and interpreting stratigraphies, in 1921.[3] Within three years from this breakthrough, 300 micropaleontologists were employed in the industry. By 1931 more than three quarters of all US oil wells used micropaleontologists in their operations. This discovery single-handedly revolutionised the oil industry and geology, bringing about what came to be known as industrial micropaleontology: micropaleontology came to be identified with the new tool of (biostratigraphy). Capitalizing on this technoscientific development, one of the foremost experts on foraminifera at the time, the American Joseph Cushman, used the profits from his work as a consultant for oil companies to open the Cushman laboratory.[4] To this day, Cushman's institute remains one of the most important sites for the study of foraminiferal micropaleontology. Others followed in his footsteps as new generations of micropaleontologists needed to be trained for the needs of the extractive industries.

The example of US industrial micropaleontology was quickly followed by researchers all over the world. For instance, in the Soviet Union, where the exploitation of the Baku oilfield had already stimulated similar work, a micropaleontology institute was established in 1930 as part of the Petroleum Geological Prospecting Institute (VNIGRI) in Leningrad. Under the leadership of Alexander Vasilievich Fursenko and, later, Nina Nicolaevna Subbotina, the institute also developed important research in industrial micropaleontology. It even extended its activities to Moscow, where Dagmara Maksimilianovna Rauser-Chernousova's research led to the discovery of more important oil fields in Baku during the second World War.[5] In this sense, the field of micropaleontology was largely formed not to answer academic and scientific questions but as an applied instrument to address geological and stratigraphic problems. In particular, it was dedicated to the extractive industries' search for (fossil fuels). This history of a scientific discipline, then, is also intertwined with the private and national concerns that developed alongside global oil interests, industries, and logistics – in particular in the formative early years of the 20th century. As two World Wars ravaged, fragmented, and reassembled planetary orders, industrial micropaleontology's importance grew as did the consumption of fossil fuels. This increased the economic power of oil companies as well as the amount of greenhouse gases in the atmosphere.

Footnotes

1. "'Bug-Men' lead hunt for Black Gold". *Popular Mechanics* (March 1932): 370-374. https://ucmp.berkeley.edu/images/pdf/bugmen3.pdf (03.01.2022).↩
2. For more on Esther Applin, see "Esther Applin 1895-1972". *Museum of the Earth*, no date, https://www.museumoftheearth.org/daring-to-dig/bio/applin (03.01.2022).↩
3. This history is told in detail in Robbie Rice Gries. "How Female Geologists Were Written out of History: The Micropaleontology Breakthrough". *Geological Society of America. Memoirs* 214 (2018): 11-22. https://doi.org/10.1130/2018.1214(02).↩

4. For more on Cushman and the laboratory, see "Joseph Cushman: Life and Legacy". no date, https://naturalhistory.si.edu/research/paleobiology/collections-overview/foraminifera-collections/joseph-cushman (03.01.2022).↩
5. For the history of Soviet micropaleontology, see Valeria Mikhalevich et al. "The Russian School of Foraminiferology". *The Journal of Foraminiferal Research* 50 (2020): 97-107. https://doi.org/10.2113/gsjfr.50.1.97; Svetlana P. Yakovleva-O'Neill and Genrieta E. Kolzova. "A History of the First Micropalaeontological Laboratory in the Former Soviet Union". In *Landmarks in Foraminiferal Micropalaeontology: History and Development*, A.J. Bowden, F.J. Gregory, and A.S. Henderson (eds.). London: The Micropalaeontological Society, 2013: 59-66. https://doi.org/10.1144/TMS6.6.↩