South for an objective, not to communize the South, but simply to unite the country. We could not stop at the 38th Parallel for a number of reasons:

(1) To stop there would have meant the possibility of future aggression on the part of a people who had been trained to aggression;

(2) To stop at the 38th Parallel would have voided the United Nations' possibility of achieving national solidarity in an area she had promised a free and open plebiscite —a plebiscite that had been offered in 1946 and rejected by the Russians who were then in control of North Korea;

(3) We couldn't stop at the 38th Parallel anyway because no matter whence the command came, the onrushing South Korean divisions were just as intent as had been the North Koreans at achieving their objective in the war—the unification of Korea.

The Russian objective in pushing the North Koreans into the war has backfired. They hoped to achieve a propaganda line showing America's aggression in the Pacific area. The United States countered with a United Nations war. The same may be said of Russia's inability to prove American military weakness. Malik's failure to achieve peace and the United Nation's drive northward have given this the lie.

What then of the future? Let us be brutally realistic. *We are in World War III.* This is not a war such as the wars we have been accustomed to, but it is World War III nevertheless. It is no less real and no less frightful because it is new and different. Perhaps never again will we be involved in a total war because mankind in general and Russia in particular know that such a war would lead to the destruction of civilization, in a conflict with only one outcome, an atomic race—or the human race.

China's Background . . .

now call Uncle Sam all sorts of names and are teaching the Chinese people how to hate their traditional friend. Now, whether this Communist regime in China is just another one of those political reforms which periodically pop up and burst, or whether the cycle of history is now due for a new turn, only the future can tell and that future is no longer China's alone.

The Young Rebel

A letter of Percy B. Shelley to an aunt, addressed as "Dear Kate," written when he was eight, closes:

"I am not
Your obedient servant
P. B. Shelley."

Reflection Seismograph Prospecting

How It Started

By WILLIAM SCHRIEVER

Imagine the calamity that would be caused by a complete lack of the essential products supplied by our petroleum industry! Millions of automobiles and trucks would stay in their garages; farm tractors would not move over the fields, and the production of food would all but cease; our tremendous earth-moving machines would not disturb a single clod; busses would not take on passengers; many municipalities would be without water, heat, and electric power; crack trains, both passenger and freight, would not move; many industrial plants would have to close for lack of heat, power, and light; ocean liners would stay in their harbors; air transportation would not exist; our Army would be immobilized and our Naval vessels would stay at anchor.

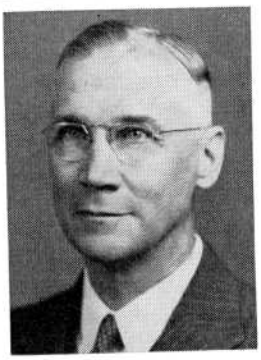
Yet, only thirty years ago this failure in the supply of petroleum would have caused only inconveniences, but no real national disaster. This change from a horse and coal economy to a petroleum-natural-gas economy has taken place almost entirely since 1920.

The discovery of sufficient numbers of oil fields to supply the necessary huge quantities of petroleum and natural gas required scientific methods of exploration. Up until the early nineteen twenties all scientific explorations were made by geologists who studied surface formations and prepared geologic maps which revealed surface indications of petroleum-bearing structures. As new oil fields became more difficult to find, new means of exploring for them were sought. Methods and instruments were required, with which it would be possible "to take a look" deep down below the surface of the earth. Such methods are called geophysical methods of exploration.

The first geophysical exploration for petroleum in the United States was made with an Eotvos torsion balance in 1922 by a crew working for the Amerada Petroleum Corporation under the direction of Dr. Everette DeGolyer, '11ba. In this same year Dr. DeGolyer also directed the work of a German refraction seismograph crew. The first salt-dome structures were discovered in 1924 in Fort Bend country, Texas; in the Nash area the torsion balance was successful, and the seismograph discovered the Orchard Dome. The Nash dome was the first oil field discovered by geophysical methods in the United States and perhaps in the entire world. The Orchard dome was the first oil field discovered by seismic methods in the United States—probably the first in the world; a refraction method with a mechanical seismograph was used.

More than a year before the first geophysical crew was working in Texas, several Oklahomans were testing their ideas concerning the reflection method of seismograph prospecting, the method which

About the Author



A bibliography of the scholarly papers which Dr. Schriever has written since coming to the University in 1919 as Assistant Professor of Physics would fill more than a page of this journal. His last article was with Louis E. Diamond: "Electromotive Forces and Electric Currents Caused by Metallic Dental Filings," Journal of Dental Research, *April, 1952. The research was sponsored by the Office of Naval Research. He has been the faculty adviser for many students who have majored in physics and has long been a close friend of Dr. Karcher.*

John Clarence Karcher, '16ba, was a member of Pe-et, Sigma Tau, and was elected charter member of Phi Beta Kappa as an alumnus. Today he is president of Concho Petroleum Co. and a director of the Republic National Bank of Dallas. He has memberships in numerous professional and honorary groups.

has been largely responsible for locating the new petroleum-bearing structures during the last twenty years. The first field tests of the reflection method were made on June 4, 1921. The first field party consisted of Dr. J. Clarence Karcher, '16ba, Dr. William P. Haseman, who was then head of the Department of Physics at the University of Oklahoma; Dr. Irving Perrine, former head of the Department of Geology at the University; and William C. "Cap" Kite, '16ba, a geologist and a former student of Dr. Perrine. Some years later Karcher developed reflection seismograph prospecting while he was associated with DeGolyer in the very successful Geophysical Research Corporation of Tulsa.

But we are getting ahead of our story of the birth of the reflection method of seismograph prospecting for oil. Karcher met Dr. Haseman, his former professor of physics at the University of Oklahoma, at the National Bureau of Standards in Washington in the summer of 1917. Since both were engaged in research on the sound ranging of big guns, and since both were familiar with the oil prospecting methods of that day, their conversations soon fell to the discussions of utilizing reflected sound waves (seismic waves) to determine the locations of oil-field structures. Opportunities to develop the method did not occur before Dr. Haseman was transferred to the University of Michigan for some special work on supersonic waves in water, and the discussions ceased until January of 1919, after Karcher had returned to Pennsylvania to continue graduate study.

At that time Haseman, who had returned to Oklahoma, began correspondence with Karcher concerning the possibility of using reflected seismic waves for prospecting purposes. Also at about this time, Karcher started the draft of a patent application concerning the method. Haseman soon invited Karcher to join a company which was to be organized to carry out investigations using reflected seismic waves. Karcher replied, expressing his great interest and suggesting that Dr. E. A. Eckhardt and Mr. Burton McCollum be invited. Eckhardt is now Vice President and Assistant Director of the Gulf Research and Development Co., concerned with exploration geophysics; McCollum is now President of the McCollum Exploration Company of Houston.

Early in the spring of 1919 Karcher conferred with Eckhardt and McCollum in Washington. After a long discussion of the method and the patent application, these three men decided to form a partnership for the purpose of pursuing the idea further. During the following summer, Dr. Karcher, after his graduate study at Pennsylvania, 1919–20, returned to the Bureau of Standards as physicist, and in his spare time assembled apparatus which enabled him to secure seismic records at the Bureau.

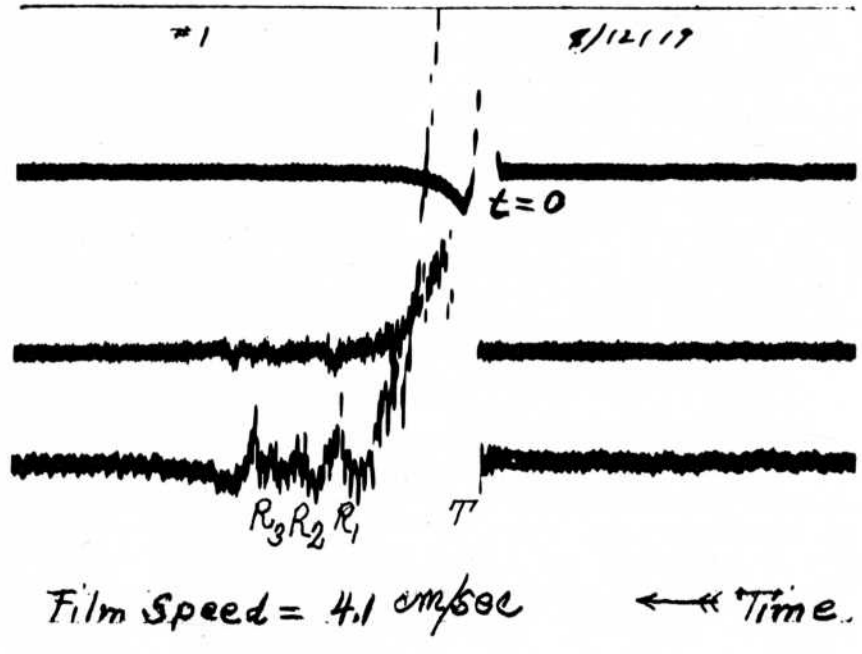
During the winter, Haseman again wrote to Karcher, this time proposing to organize a company for the purpose of exploiting their ideas concerning reflection seismograph surveys. Professor Haseman, in collaboration with Dr. D. W. Ohern, at one time Director of the Oklahoma Geological Survey, Irving Perrine, Mr. Frank Buttram, former member of the staff of the Survey, and others, organized the Geological Engineering Company in 1921. Karcher dissolved his partnership and joined this company. Messrs. McCollum and Eckhardt were retained as consultants, and were given stock in the company for their services.

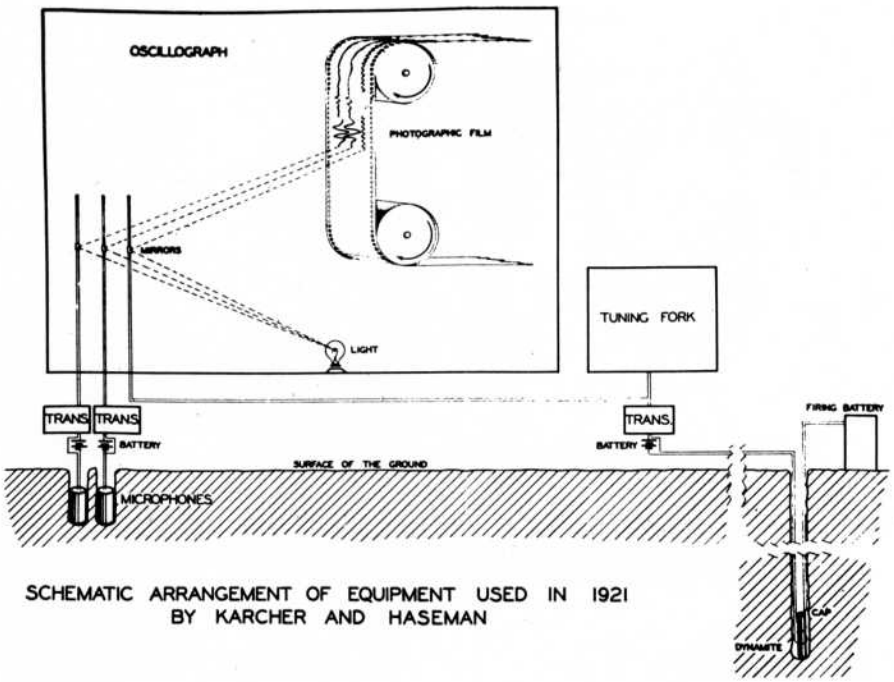
During April of 1921, while Karcher was still in Washington, he designed and arranged for the purchase and construction of suitable apparatus for recording seismic reflections. He followed the apparatus to Oklahoma in May and in collaboration with Haseman completed the construction during that month.

The first field trip for testing the apparatus was made on June 4, 1921. This seismograph party was composed of Karcher, Haseman, Perrine, and Kite; it probably was the first seismograph exploration party to operate in the United States. The first observations were made in a stream bed about one and one quarter miles due west of Belle Isle, a suburb in northwest Oklahoma City. Experimental field work was continued on June 6, 8, 9, 10, and forward. On June 16 a profile consisting of a series of seven shots spaced 100 feet apart and from 100 to 700 feet from the detector, was made. On the following day a similar profile extending from 300 to 1000 feet from the detector, yielded additional seismic records. These experiments were continued until early in July.

On July 14, 1921, a seismograph party

The world's first exploration seismograph record was made in a rock quarry north of the National Bureau of Standards in Washington, D. C., April 12, 1919, by Dr. Karcher. On the top trace of the tuning fork is shown the explosion instant at "t=o." On the lowest trace of a seismograph, T marks the instant of the arrival of the ground wave, and R_1, R_2, and R_3 record the arrival of reflected waves after explosion.





SCHEMATIC ARRANGEMENT OF EQUIPMENT USED IN 1921 BY KARCHER AND HASEMAN

Schematic diagram of the apparatus used by Dr. William P. Haseman and Dr. J. Clarence Karcher in 1921. It was the world's first exploration reflection seismograph.

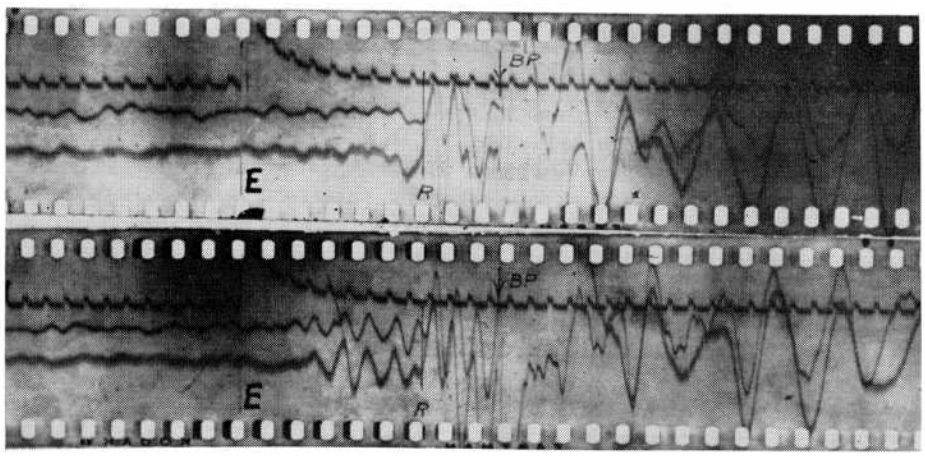
consisting of Doctors Karcher, Haseman, Ohern, and Perrine went to the Arbuckle Mountains and, with the aid of dynamite explosions, determined the seismic wave velocity in the Hunton limestone to be 11,680 feet per second. During the next two days they measured the wave velocities in the Sylvan shale and the Viola limestone, and found them to be respectively 5,780 and 14,070 feet per second. These results showed that the contact between the Sylvan shale and the Viola limestone would make an excellent horizon for reflecting seismic waves.

Dr. Ohern then led the party to an area, known as Vines Branch, about seven miles north of Dougherty, Oklahoma, where a structural dome was known to exist. The caprock of this dome was the Viola limestone and this was overlain with Sylvan shale on the flanks of the dome. East of this dome the Viola plunged eastward and the depth of the shale increased as the distance from the dome increased. It was along this west-east line that the next experiments were conducted.

Along this line, nine shot-points were located at 100 foot intervals. At right angles to this line and 300 feet away were located the detector stations, one for each shot-point. This arrangement permitted a series of observations to be made where all conditions were constant except that the depth of the reflecting horizon (the Viola) increased with increasing distance from the dome. Records of well-defined reflections were obtained from the Viola limestone at varying depths up to 400 feet, and Karcher was able to make calculations from the records which showed how the depth of the Viola changed with distance from the dome. During August of that year additional experiments were conducted near Oklahoma City.

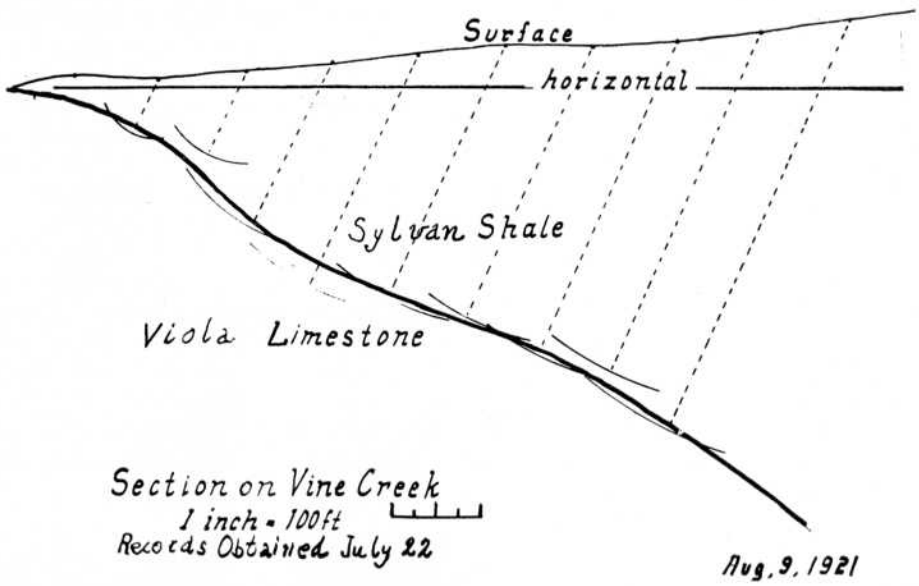
On about September 1, 1921, a party consisting of Doctors Karcher and Haseman, and Mr. Reginald G. "Rex" Ryan (a geologist and former student at the University of Oklahoma) went to Ponca City, Oklahoma, to carry out seismic reflection experiments on the Newkirk anticline, a location some fifteen miles northeast of that city. Ohern, F. Park "Spot" Geyer, Chief Geologist of the Marland Oil Company, and his associate, Fritz L. Aurin, '14ba, '15ma, both former students of Perrine, assisted in locating suitable sites for the work. Many records showing identifiable reflections were obtained at various reflecting angles.

On September 13, a survey was begun for the Marland Oil Company in Section 28, Township 25 N, Range 4W. Work on the South Ponca structure was begun on October 14; on the Kildare area on Oc-



Two reflection seismograph records from those obtained during the survey for the Marland Oil Company. E indicates the time of dynamite explosion; R the time of arrival of reflected seismic wave; BP the arrival of the blast of explosion through the air. Top trace was supplied by the timing device (tuning fork): it served to record the explosion instant and to measure the time interval between the explosion and the arrival of the seismic wave at the dector (microphones). The other two traces are records of seismic waves, made by the two detectors. Tests made in Sept., 1921.

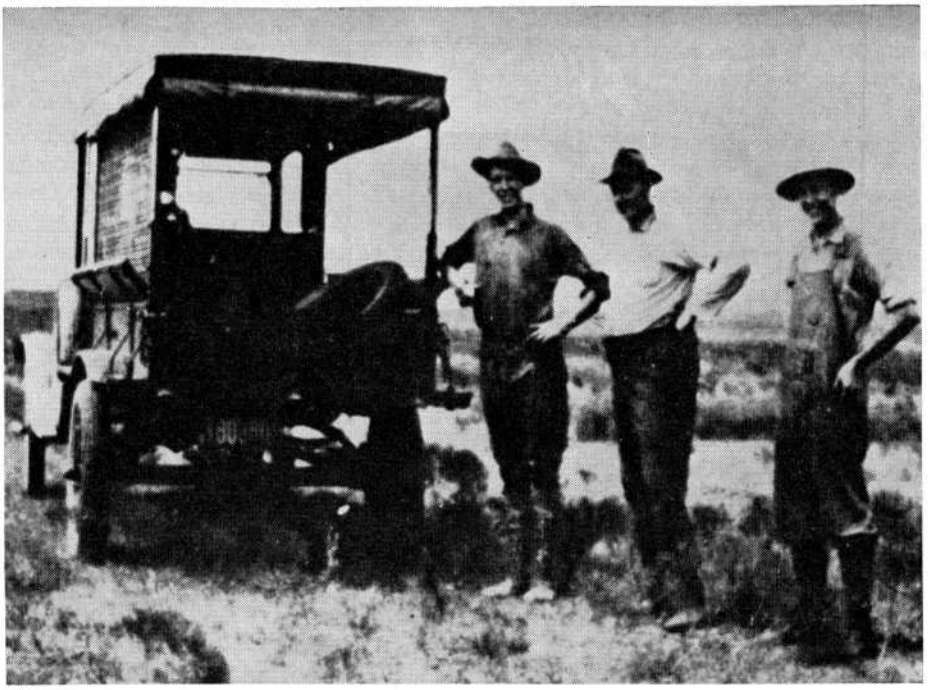
Depth of the Viola limestone at Vines Branch was measured with reflection seismograph on August 9, 1921—world's first reflection seismograph geologic section.



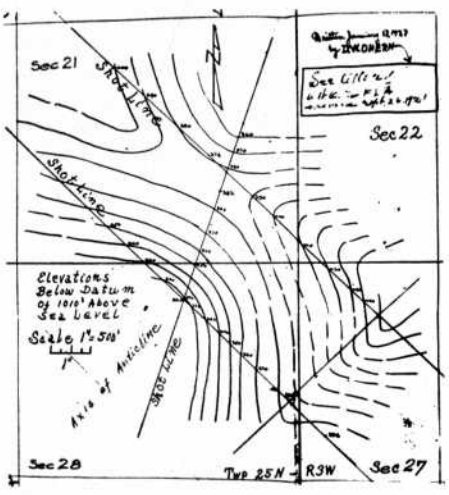
tober 18; and on the Deer Creek structure on October 26. It is interesting to note that by this time the explorers had developed the now well-known technique of placing dynamite well down in the subsoil and of filling the shot holes with water to increase the efficiency of production of seismic waves.

Funds for the experimental work were so meager that the program was abandoned about January 25, 1922. Karcher then returned to the National Bureau of Standards as Research Physicist. Later, in 1923, he accepted a position with the Western Electric Company in Chicago. Reflection seismograph prospecting for petroleum had not yet achieved any noteworthy results, but the fundamental idea had been shown to be correct; only adequate financial resources were needed to develop the techniques into the most valuable of petroleum exploration methods. This development was soon to begin because another alumnus of the University of Oklahoma arranged for adequate financing of the project.

In 1925 Harold V. Bozell, a former professor of Electrical Engineering at the University and one of Karcher's former teachers, told Dr. DeGolyer of the seismograph work which Doctors Karcher and Haseman had been doing. DeGolyer, then Vice President of the Amerada Petroleum Corporation, was very much interested in the work and immediately arranged to interview Karcher in New York. Shortly thereafter Karcher was informed that the Amerada Petroleum Corporation would finance the necessary seismograph research to the extent of at least one hundred thousand dollars per year for a period of three years. Karcher resigned his position with the Western Electric Company and began work with Amerada on June 1, 1925. Shortly thereafter the Geophysical Research Corporation (now in Tulsa) was organized with DeGolyer as President and Karcher as Vice-President and General Manager. Within a few years the Geophysical Research Corporation became the largest operator of refraction seismograph equipment in the United States and one of the largest in the world. The refraction method was well adapted to the search for shallow salt domes in the Texas Gulf Coast area.



The first exploration seismograph party to operate on a geologic structure in the United States: Oklahoma, August, 1921. The seismograph party consisted of Mr. Reginald G. "Rex" Ryan, Dr. William P. Haseman and Dr. J. Clarence Karcher.



The world's first contour map of a geologic structure based on reflection seismograph data was prepared by F. L. Aurin, '14ba, '15ma, from data obtained near Ponca City by Doctors Karcher and Haseman for Marland Oil in Sept., 1921.

In 1929 Karcher sold his interest in G.R.C., and resigned his position there in 1930. He immediately organized another seismograph exploration company called Geophysical Service, Inc. This company specialized in reflection seismography and readily gained pre-eminence in this field. By 1938 it had thirty-four seismograph crews working throughout the United States, Canada, South America, and the Far East. On January 1, 1939 the activities of the Geophysical Service, Inc., were divided and placed under two corporations, one engaging in the oil business under the name of Coronado Corporation, and the other in the exploration business under the name of Geophysical Service, Incorporated. Karcher continued with management of the oil company. In 1941 he negotiated the sale of both companies, the oil company being sold to the Stanolind Oil and Gas Company for a consideration of more than $5,000,000. The Geophysical Company was sold to four of its employees. Geophysical Service, Inc. is still one of the most important reflection seismograph petroleum exploration companies of the world.

Dr. Haseman's active life came to a close in 1932, but before he died, the reflection method of seismograph prospecting, which he and Dr. Karcher had labored so hard to bring into being, had become the leading method for petroleum exploration. Perhaps it should be called the Oklahoma Method of seismograph prospecting because it was developed in Oklahoma by Oklahomans nearly all of whom were alumni or former faculty members of the University of Oklahoma. Perrine, Ohern, Kite, and Buttram now live in Oklahoma City; Aurin resides in Fort Worth. Without doubt the success of the reflection method of seismograph prospecting has been far greater than could have been the wildest dreams of the men who observed the first seismic reflections in 1921.

Like a Strawberry

Talking of Pleasure, this moment I was writing with one hand, and with the other holding to my Mouth a Nectarine—good God how fine. It went down soft, pulpy, slushy, oozy—all its delicious embonpoint melted down my throat like a large beatified Strawberry.

Letter of John Keats to C. W. Dilke, September 22, 1819.