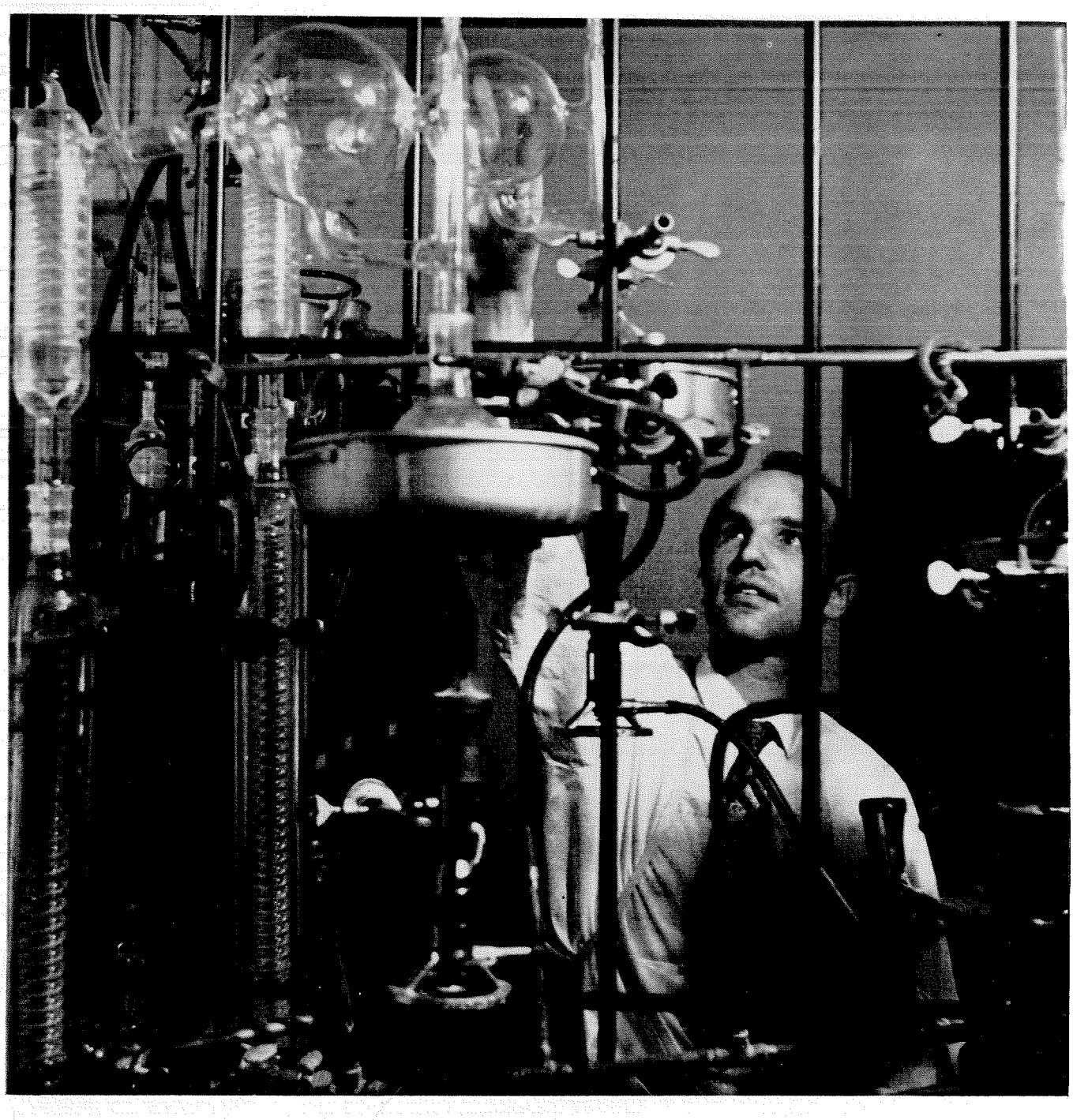
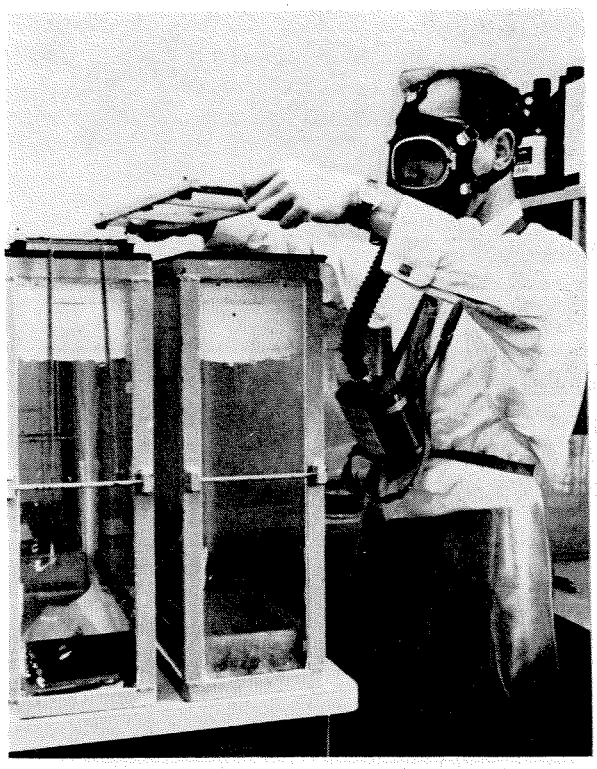


METEORITE RESEARCH

A number of scientists are convinced that meteorites which flash into the earth's atmosphere from outer space contain remnants of extra-terrestrial life. When Egon T. Degens, assistant professor of geology at Caltech, recently received some samples of meteorites from Drs. H. E. Suess and G. Goles at the Scripps Institution of Oceanography in La Jolla (half of their precious supply) he decided to try to get some data which would prove or disprove this theory.

Meteorites that hit the earth are believed to be strays from a belt of countless thousands of them, called asteroids, that orbit around the sun between the planets Mars and Jupiter. One theory is that they are fragments of another planet that was somehow



In studies on meteorites, Dr. Degens wears a protective gas mask as he makes a chromatographic analysis of biological material in a tank containing highly poisonous solvents. This analysis separates one kind of biological material from another.

shattered. Using radio-isotope age-dating techniques, Caltech geochemists have determined that all the meteorites that have been found so far are about 4½ billion years old.

The samples that Dr. Degens received were two different kinds of meteorites – one known as the Bruderheim chondrite that fell on frozen ground in Canada in 1960, and the other called the Murray carbonaceous chondrite that fell in Kentucky in 1950. (Meteorites get their names from the areas in which they are found.) Both are so porous that bacteria could easily enter any part of them.

The meteorites have a hard, thin coating of melted rock, which presumably developed from friction when they entered the earth's atmosphere. The coating was cracked because of the subsequent quick cooling or impact with the earth. Microbes could be sucked into the meteorites through the cracks, along with air rushing in to fill the vacuum immediately or shortly after entering the earth's atmosphere. Also changes in barometric pressure may produce something like a "breathing" effect, flushing certain constituents into or out of the meteorites.

In the Caltech geology laboratory, small pieces of the center parts of the meteorites were ground into about a tablespoon of fine dust. The samples were not sterilized because they had already been handled without any such precautions.

With his co-worker, H. J. Reuter, postdoctoral research fellow at Caltech, Degens developed a special micro-analytical technique for examining this material. By chromatographic analysis, the scientists extracted and separated a complex of compounds that only living things could have synthesized in this particular combination. These were free and combined amino acids, amino sugars, nucleic acids, and simple sugars.

The fact that the *same* biological residues were found in both samples is significant. From the mineralogy of meteorites it is reasonable to assume that chondrites have been subjected at one time in their long history to high temperatures – as high as 1,800° F.; while the carbon-containing chondrites remained fairly cool at all times – no higher than 200°.

If the biological material in the Bruderheim meteorite is considered to be a form of extra-terrestrial life, then it must be assumed that the material existed after the meteorite went through exceedingly high temperatures. And when the presumed long history of the two genetically different meteorites is taken into account, the similarity of the biological matter found in the two becomes even more puzzling.

After the biological material was extracted from the specimens, the two residues of meteoritic dust were left in dishes covered with filter paper, through which microbes could easily pass. This dust had been thoroughly leached of all delicate biological material originally contained in the meteorites, yet in three weeks, when the dust was re-examined, new biological material of the same type was found – certain evidence of a recontamination.

This research suggests that both meteorites – as well as three others from different parts of the world which have been tested in the same way – represent an excellent environment for the growth of microorganisms. Apparently the peculiar chemistry of meteorites, in terms of sulphur content, high iron concentration, or the various oxidation states of heavy metals, stimulates the activity of certain terrestrial microbes, and even accelerates the production and accumulation of terrestrial biogenic organic matter.

It may be of interest to add that the organic spectrum of chondrites strikingly resembles the one of oxidizing recent marine sediments, but differs considerably from any other spectrum obtained from any ancient or recent rocks.

Although it would undoubtedly be more attractive and exciting to prove that extra-terrestrial life rides in on meteorites from outer space, the present facts point more in the direction of a simple terrestrial contamination.