

ASTRONOMY

Moon's Face Was Pelted

Swarm of heavenly objects in a "sediment ring" blasted lunar surface during three stages of its melting, Dr. Gerard Kuiper of Yerkes Observatory proposes in new theory.

► THE "MAN" in the moon" resulted from impact of a swarm of heavenly objects on the lunar surface during three stages of the moon's melting, Dr. Gerard P. Kuiper of University of Chicago's Yerkes Observatory reported to the National Academy of Sciences in Washington.

Two types of theories have been proposed to account for the surface features of the moon. One is that the moon's craters were formed like most of those on earth, by volcanic action. The other is that meteorites smashing into the moon's surface caused the craters, as some are thought to have been formed on earth.

Dr. Kuiper observed the moon for nearly a year with the 82-inch telescope of the McDonald Observatory, Mt. Locke, Tex., operated jointly by the Universities of Chicago and Texas. He concluded that the impact theory is confirmed as the chief cause of lunar surface features. He used a binocular attachment that magnifies 900 times for his observations, thus getting better detail than even the best lunar photographs.

Dr. Kuiper said that the moon, as it sped away from the earth, plowed through a "sediment ring," a swarm of small satellites moving around the earth. The asteroid ring and the ring of Saturn are two such sediment rings now observable.

Originally, the earth and the moon were close together, a double planet with a very dense atmosphere. After the earth solidified and cooled, its oceans began to form.

Tidal friction produced on earth by the oceans sent the moon on its outward journey and into the sediment ring. As the larger bodies in the ring hit the moon, they formed craters. This occurred during the pre-melting period, when the moon's surface consisted of loose rubble.

Dr. Kuiper reported in the *Proceedings of the National Academy of Sciences* (Dec., 1954) that the moon and the earth are about 5,000,000,000 years old, a figure based on the analysis of meteorites. At that time, the heat production of radioactive uranium and potassium was about ten times greater than now, both for meteorites and the moon.

All spheres larger than about 60 miles in diameter would melt close to the center in about 1,000,000,000 years, Dr. Kuiper calculated. Much larger spheres would be entirely melted, except for a thin outer crust that remained solid.

During the stage of maximum melting, the maria, or seas, were formed. These are the dark areas on the lunar surface that make the face of the "man in the moon."

They were caused, Dr. Kuiper believes, by impacts that broke the moon's crust and caused large exposures of lava, although not all at the time.

The last stage in the moon's thermal history, Dr. Kuiper labels postmelting. It was during this period that the large ray craters and the thousands of small white craters were formed. These are best seen at full moon, while the premelting craters are nearly invisible at full moon.

While the moon was cooling, large quantities of steam escaped from its center and passed through the crust, "baking" it and leading to numerous fumaroles. When struck by objects in the sediment ring, this material became a substance resembling powdered glass, giving the white appearance.

It is possible, Dr. Kuiper suggested, to get direct information on the make-up of the lunar surface from an analysis of tektites, rounded, glassy bodies found on the earth's surface that some scientists believe are ejected from the lunar surface by the impact of meteorites.

In spite of the thousands of smaller bodies collected by the moon, the few large impacts contributed most of the mass added to the earth's satellite during the impact period. The total material swept up by the moon was about a five-thousandth of its mass, Dr. Kuiper calculated, which is "consistent with" the sediment ring theory.

The surface of the moon, Dr. Kuiper concluded, offers a "unique opportunity to study the composition of a sediment ring" shortly after its formation. He regarded it as a coincidence that the moon struck this ring near the time of its maximum melting.

Further studies, he said, could define where the sediment ring occurred and provide information about the moon's birthplace.

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AGRICULTURE

Clover Seed Supplies Short, Farmers Warned

► FARMERS HAVE been warned by the U. S. Department of Agriculture that they "must decide within the next few weeks how best to meet the problem of short supplies of red and alsike clover seed."

The seed supply of these two legumes is the smallest in years, the Department's agronomists reported. This year's supply amounts to only 80% of the 1943-52 ten-year average.

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COLOR TV—A color television camera, shown amid the operating lights, views surgery at Walter Reed Army Medical Center. The doctors can lecture or answer questions from students watching the operation on closed-circuit television receivers.

GENETICS

Heredity Units Made of Corkscrew Fibrils

► CHROMOSOMES, THE units in the cell that transmit parental characteristics to the offspring, are made up of tiny shreds, or fibrils, coiled like a corkscrew and about one twenty-five millionth of an inch thick, according to a theory presented to the American Association for the Advancement of Science meeting at Berkeley, Calif.

The theory was worked out from electron microscope findings by Prof. Hans Ris of the University of Wisconsin. It may provide the first step in answering an elementary but hitherto puzzling question about the structure of the chromosomes.

During cell division, chromosomes split lengthwise, each half going to a daughter cell and furnishing the master-pattern that the daughter cells follow in growing into a likeness of the parent. This method of cell division is the way old body cells are replaced by new young cells identical in structure and function to the old ones.

It is also the means by which sperm cells and ova are created, each containing the chromosomal master-pattern of a parent, which merge to produce an offspring with characteristics of both parents.

During the process of cell division the tiny fibrils making up the chromosomes apparently enlarge until they are twice as thick. Then they split lengthwise, giving rise to two new fibrils, Prof. Ris found.

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