

ASTRONOMY

Moon Like Hollow Sphere

► THE MOON is like a hollow sphere, heavier on the outside than on the inside, according to data from the Vanguard satellite and theories about the moon.

Most scientists believe the moon is denser in the interior but it could possibly have become heavier on the outside from heavy meteors falling on the surface.

When man gets to the moon, he can find out more about both how the earth and the moon were formed, Dr. Gordon J. F. MacDonald of the National Aeronautics and Space Agency reports. He believes the moon was originally hot because its radius has not changed much since it was formed.

This he concluded from studies of photographs of the moon. He said none of the moon mountains (craters) showed one side had moved relative to the other as they would if the radius had changed.

Several theories have been suggested to explain how the moon began moving around the earth. Dr. MacDonald believes the moon may have been "captured" by the earth about a billion years ago.

In that case the moon might have been a small planet coming close to the earth in its travels around the sun. At one point as

it came close to earth, under special conditions involving the relative motions of the earth, the moon and the sun, the moon could have been captured. It could also have come from the asteroid belt (a belt of small bodies believed to be scattered parts of a larger one).

The moon is moving away from the earth at about one half inch a year. The possibility of the moon's capture is based on the assumption that the moon has been moving away from the earth at a steady rate, Dr. MacDonald says.

If the moon's receding rate has changed as the moon moved away, another theory is plausible, namely that the moon was created at the same time as the earth, and nearby, and has moved around the earth since it was formed.

A third theory was developed by George Darwin, son of Charles Darwin who developed the theory of evolution. This theory suggests that the moon was drawn out of the earth in a huge chunk.

Dr. MacDonald gives a complete discussion of possibilities for the earth-moon relationship in *Science*, 133:1045, 1961.

• *Science News Letter*, 79:244 April 22, 1961

ICHTHYOLOGY

Light Kills Fish Embryos

► LIGHT IS A DEATH RAY when it strikes the eggs and developing embryos of salmon and trout. It can kill in just a few minutes, and it probably is just as deadly to the sensitive young of all other water-dwelling animals, a New York biologist believes.

When the death rate among brook trout eggs at the New York State hatchery, Cold Spring Harbor, suddenly shot up to 90% from 10% in November, 1959, Dr. Alfred Perlmutter of New York University discovered that the culprits were the 40-watt fluorescent bulbs in the ceiling.

Another investigator, working with rainbow trout, found that the violet and blue components of white or visible light are more deadly than the green, yellow and orange bands.

Direct sunlight is known to kill salmon and trout eggs, and it might be inferred from this that ultraviolet light is responsible. But indirect light, with no ultraviolet, has also killed sockeye salmon eggs and embryos.

On this basis, Dr. Perlmutter suggests that visible light is potentially lethal to all water-dwelling animals and that these species have survived only because they have been able partially to shield themselves from light.

In nature, he states in the journal *Science*, 133:1081, 1961, fish eggs may be shielded by gravel, a nest, the parent's body or the shadow of rock crevices or abandoned sea shells.

A large number of fishes spawn when the weather is rainy and the water turbid and dark. Even the eggs themselves are colored, more so in nature than in the hatchery, and color cells develop over the vital parts of the embryo.

When the spawning season includes a long period of clear, sunny weather, Dr. Perlmutter states, it is a safe bet that fewer young fish will survive.

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GEODESY

Earth's Shape Is Far From Smooth

► THE EARTH'S SHAPE now can be determined with better precision than ever before, using artificial earth satellites, Drs. Fred L. Whipple and George Veis of the Smithsonian Astrophysical Observatory, Cambridge, Mass, reported in Florence, Italy.

For the first time, scientists can measure the shape and size of the earth with a precision of from 30 to 50 feet, they told a symposium before the International Committee on Space Research meeting. This is ten times better than pre-satellite techniques using older methods of geodesy, such as gravity measurements and precision position determinations by star observations.

Analysis of satellite motions has shown earth irregularities from pole to pole. The equator itself is not a circle but elliptical.

These results, the work of Imre G. Izsak, also of the Observatory, mean that the earth may have either irregularities in shape or vary in density from place to place, the scientists said.

To locate these irregularities geometrically within 30 to 50 feet, artificial satellites are being observed from 12 precision satellite tracking stations located around the world. Other stations are being added to the system. When the geodetic coordinates of all the countries of the world are united in one system, results will be ten times again more precise than those known today.

The work of the Observatory, originally a part of the International Geophysical Year, now is supported by the National Aeronautics and Space Administration.

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