SCIENCE NEWS

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MIRA, THE SECOND LARGEST STAR

A GLOBE of glowing gases 250,000,000 miles in diameter, so vast that if the sun were placed at its center there would be sufficient room for the earth to revolve in its customary orbit; such is the nature of the star Omicron Ceti, known to the ancients as Mira, "the wonderful," because of its remarkable and periodical variations in brilliance.

The observations from which these measurements were calculated were made by Francis G. Pease, astronomer at the Mt. Wilson Observatory, Pasadena, California, using the great 100-inch reflecting telescope, the largest in the world. The method employed was one invented by Professor A. A. Michelson, of the University of Chicago, by means of which a device called an interferometer is attached to the top of the telescope.

With a system of mirrors, the light from the star is divided into two beams, which, when reunited, give rise to a series of light and dark bands. This is because the waves of light in the two beams get out of step and thus, at certain positions, interfere with each other. It is analogous to what might occur with waves in a pool of water. If there are two sets of waves, the peaks in one coinciding with the troughs in the other, they will tend to cancel each other. This effect is called "interference."

When the mirrors of the interferometer are moved, a place is found where the interference bands vanish and from the distance apart of the mirrors at this point, the apparent diameter of the star may be calculated. This is the angle between two lines coming from opposite edges of the star and meeting at the earth. In the case of Mira, the apparent diameter is about six hundredths of a second of arc, the same as that of the head of an ordinary pin five miles away!

Obviously this apparent diameter has no direct relation to the actual size, for a small object nearby may appear larger than a much greater one at a distance. By other means, however, the distance of the stars may be determined and when known, the actual diameter may be calculated. Thus Mira is about 165 light years away. A light year is the distance that light can travel in one year, about 6,000,000,000,000 miles, since it can encircle the earth seven times in a second! The distance of Mira from the earth is therefore too many billions of miles to think about.

Since 1920, when Michelson's method was first applied to the measurement of stellar diameters, Mr. Pease has measured five other stars. The first one was Betelgeuse, a bright star in the constellation of Orion, which now adorns our southwestern sky in the evening. Alpha Orionis, the astronomers call it and it may be seen above the three stars in a row that form Orion's belt. Its diameter is 215,000,000 miles.

After this he measured Arcturus, in the constellation of Bootes, which he found to have a diameter of 20,000,000 miles, Aldebaran, the red star in Taurus, the Bull, which is 30,000,000 miles across; Scheat, the second brightest star in Pegasus, which is 150,000,000 miles; and, largest of all, Antares, "the rival of Mars," in the Scorpion with 400,000,000 miles!

Mira, therefore, is the second largest star known but it is important because it is a variable star. Periodically it varies from the second magnitude, when it is prominent in the southern sky in early winter evenings, to the eighth magnitude, when it is too faint to be seen by the unaided eye. Another feature of great interest is that it is a double star. It is not a single body, but consists of two stars close together, and which revolve around each other. The companion was discovered about a year ago by Dr. Robert G. Aitken, associate director of the Lick Observatory, with the 36-inch refracting telescope there, after Dr. Alfred H. Joy, at Mt. Wilson, had predicted its presence by studying observations of the star made with a spectroscope.

CRIMEAN NEANDERTHAL REMAINS

PROFESSOR BONTISCH-OSMOLOVSKY in an interview with a Science Service representative has stated the details of his recent find of two primitive human Neanderthaloid skulls near Simferopol, in the Crimea, hundreds of miles to the eastward of any previous discoveries of that race of cavemen.

"I had an idea that when the last glacial period began, something less than fifty thousand years ago, the men then living retreated before the oncoming cold into the country now known as the Crimea," said Professor Bontisch-Osmolovsky. "In 1923 I began systematic explorations to test this theory, twenty-five miles from Simferopol, near the village of Kipchak. In a cave known as Koush Kbat I came upon my first evidences. I found here skeletal remains of the mammoth, Siberian rhinoceros, cave hyena, cave bear, wild horse, wild ass, deer and other animals, together with a number of small primitive tools and the remains of a hearth, which indicated that the cave had once been a dwelling place of human beings.

"In 1924 I made my first find of actual human remains in a neighboring cave called Kiik Koba, in geological strata of the quaternary period. Here were two fragmentary hearths, with layers of ashes and coals and here, in regularly made graves, were two human skeletons. In this cave also were remains of the same animals I had found in my first explorations, together with many flint implements, typical of the Middle Paleolithic period. This is the first find of its kind ever made in Russia, and is in my opinion a discovery of great scientific importance.

"The bones are very different from those of modern man. Their measurements have not yet been completed, but those so far made suggest that they are representative specimens of the Neanderthaloid race. Some pieces,

including a part of one of the skulls, are still missing, and I hope to find these by further search. Investigation of all the material in the Kiik Koba cave can not be completed in Russia, since there is no comparative material in this country for a study of Middle Paleolithic Quaternary man.''

Professor Joukoff of the Anthropological Research Institution states that statistical analysis of the bones of the Kiik Koba skeleton gives data approaching the Neanderthaloid type, with even a partial inclination toward the conformation of the anthropoid apes. A final decision will be pronounced when the data can be compared with figures for Neanderthal remains from older finds in western Europe.

The primitive cave men that roamed Europe from about 50,000 B. C. to 25,000 B. C. were a race that has left no direct descendants, so far as scientists can judge to-day.

This early race lived in a very cold and wet climate in the midst of the great Ice Ages. Its name, Neanderthal, is derived from the limestone valley of the little Neander river in Germany, in which the first skeleton was found by anthropologists. Subsequent to the first or type discovery about twenty other finds of remains of this race have been made principally in France, though they extended eastward as far as Moravia in what was formerly Austria-Hungary and as far south as Gibraltar. One skeleton, that of a woman, has been found at Gibraltar; at Chapelle-aux-Saints, in France another skeleton; in the cave of Spy, in Belgium, two skeletons. At La Ferrasie the remains of seven or eight persons were found and at La Quina a wholesale burial of fifteen. Other smaller finds have been made, sometimes consisting of but a fragment of a skeleton.

Together the finds constitute a rich fund of material from which much information has been deduced. They were a squat, blocky people, probably walking with a shuffling, shambling gait, instead of freely and erect, like the tall Cro-Magnons, who later replaced them. They had heavy jaws and powerful teeth, indicating a diet of tough food, much of it possibly raw. They were decided ''low brows,'' with backward-sloping foreheads.

Yet they were not brutes. They had large brains and knew how to make stone tools. We even can be fairly sure that they were right-handed, for one side of the brain was larger than the other. They had little or no art but they had at least the beginnings of religion, for they buried their dead.

It is unlikely that they are part of modern man's family tree, for they had many features that are not represented in the present human types. There is just a possibility, lately emphasized by a French anthropologist, that some of the more primitive of modern savages may have a strain of Neanderthaloid blood in them. But to most of the present-day human race, they were great-uncles rather than grandfathers.

COAL, JEWEL AND FUEL

COAL is like character, the deeper you go into it the more interesting it becomes and there is much in it that, unsuspected, is beautiful. Ordinary bituminous coal is dirty, black and uncouth and anthracite is none too clean; but if you cut from a lump of coal a slice thin enough to be translucent and examine it under a microscope you will see what beautiful things coal is made of.

The preparation of such a thin section is a most delicate task. First a thin flat piece from a lump is sawed out and then ground down smoothly until it is reduced nearly to a film—that is, until it averages about 2/10,000ths of an inch in thickness. This thickness—or rather thinness—would correspond to the leaves of a book in which 14,000 pages make a volume only one inch in thickness.

Seen through the microscope such slices of coal are found to be translucent and if treated with certain chemicals before grinding, they will be so beautifully translucent that they may be examined by a microscope which magnifies them more than 1,800 times.

Under the microscope the coal is no longer dark as night, or sooty or forbidding. In the cross section of that dirty lump one beholds a landscape in brown and gold. Golden links in serried chains bound in filigree fill portions of the view.

The links are the cross sections of the cells of pieces of wood of twig, branch or log that enter into the product we call coal. Each cell in the wood is a jewel box of gold. In the hollow interior where once were protoplasm, starch and other substances embracing the very life of the plant, we find a transparent amberlike substance clouded with sepia and containing clusters of shining crystals of utmost minuteness, together perhaps, with tiny glistening globules of gas. Stem of leaf and fern and scale of catkin or cone, are seen in tissues traced in saffron and orange, straw-color and russet. Scattered here and there are a thousand spores of club moss, fern or fungus and pollen of many kinds of flowers, now appearing as ovals, clasps and crescents of luminescent brass or antique gold. Festooning skeins in brown, knit with silver representing cross sections of fragments of inner tissue of leaf or bud are perhaps present; and resins of different kinds, brownish, amber, yellow or red, stud the pattern like precious stones. Real amber used in jewelry is, you know, a fossil resin. Yonder mesh of old gold sealed over with a mosaic in glistening topaz-yellow is a piece of the outer wall of a leaf. The fragile labyrinths traced in pale yellow and silver are the cross sections of fragments of ''mineral charcoal,'' the so-called ''mother of coal.'' The scene changes from area to area and from specimen to specimen.

All these details of tracery and mosaic are set in a background—the groundmass—of cinnamon verging into sepia and brownish black, which fills the spaces. This composes the dark shadows of the picture.

Geological as well as the microscopical study of coals proves that all the ordinary kinds of coal, including anthracite, began their existence as peats deposited in vast swamps that once spread back of the low coasts or in the interior lowland basins of the continents in ancient geological times. The wood fragments, twigs, leaves, seed coats, spore cases, now chemically transformed in colors of gold and brown, are the plant

débris that was saved from decay by the germ-poisonous products developed by bacteria at or near the surface of the peat on which this débris was deposited. However, the great chemical and physical transformations by which the peats were changed to lignite, subbituminous, bituminous, semibituminous coals and anthracites have been brought about by geological processes instead of by bacterial action. The principal agents in this geological transformation are pressure, heat and time.

The pressures taking part in the conversion of peats to coals of different ranks are, first, the downward pressure of weight of hundreds—perhaps many thousands—of feet of beds of sand, mud, limestone, etc., piled on top of the peat bed as the region was sinking or the basin was filling. Second, and far more effective, however, are the horizontal pressures which build mountains by causing great wrinkles in the earth's crust.

Most earthquake zones are the scenes of compression and mountain building, though the movement is invisibly slow. The coals have progressed farthest on the road to anthracite and graphite in those regions where the greatest actual horizontal compression of the peat containing strata has taken place.

The temperatures developed in the process are those due to depth of burial of the deposit. This amounts to about a degree Fahrenheit to each 80 feet downward through depths averaging about 2,000 feet. Added to this is the heat generated by friction due to the compression through millions of years of the rocks as just described and also the heat caused by chemical action in the buried strata. Altogether, the temperatures in the coal beds were probably less than 300 degrees Fahrenheit in most coal regions. Lowness of temperature is, however, compensated by great length of geologic time, time and temperature being, in fact, partially interchangeable in the geological transformation of coals.

Coal is still the world's greatest source of industrial power and it will remain so for a long time, for the coal reserves of the world probably exceed 10,000 billion tons. Our portion, over 3,500 billion tons, of these vast supplies, should last us many centuries in spite of increasing population and expanding industries, though our coal exportation probably will not grow correspondingly. The actually depressing feature is that we are rapidly mining our limited reserves of best and most valuable coals first. It will be no long period before our so-called smokeless or Navy coals will be largely consumed and we shall be using inferior and generally dirtier coals mined from thinner beds, at greater depth and at greater cost.—*Dr. David White.*

THE MENTALITY OF CRIMINAL DELINQUENTS

More than half of 10,000 criminal delinquents examined by the National Committee for Mental Hygiene have been found to be mentally diseased, feeble minded or otherwise mentally abnormal. This number included inmates of prisons, reform schools and those on probation to the courts.

As a result of this examination Sing Sing will establish a psychiatric clinic to study each prisoner upon entering. The subnormal will be segregated from the normal and kept under state control. Massachusetts has passed a bill requiring the psychiatric examination of all prisoners sentenced for more than thirty days and those arrested more than once.

The bulk of the prison population is made up of repeaters.

"In the study of 608 admissions to Sing Sing prison 66.8 per cent. were found to be recidivists or repeaters. In other words, they had previously served sentences in one or more penal institutions. In the survey of the Texas penitentiary where more than 3,000 were examined, 58 per cent. had been arrested previously according to their own admission; and in the study of the 34 New York county jails, 66 per cent. were repeaters and 27.9 per cent. had been arrested four or more times," according to the National Committee for Mental Hygiene.

"It is with this group of offenders that society must learn to deal if it ever hopes to achieve anything in its struggle with the problem of crime," the committee warns. "It has in recent years thought somewhat more of reformation and a little less of retribution and in its attack upon the problem has made extensive use of the instrument of probation. The results have not been altogether satisfactory and there has ensued a reaction manifesting itself most markedly in criticisms that charge sentimentality and denounce the leniency of many of the courts and juries in their dealings with prisoners. But the weakness of probation has been in the absence of competent direction and advice in the examination and treatment of offenders and the oversight of the vitally important mental and emotional factors that can not be ignored in any attempt to understand the behavior of these offenders and prescribe adequate rehabilitative measures."

ITEMS

Buildings may be rendered secure against the ravages of the wood-eating termite, or white ant, by a method described by Professor S. F. Light, of the University of Amoy. Professor Light's method depends on the fact that some termites require constant access to the earth to carry on their operations, either through galleries which they bore through the wood or through covered ways which they construct over the faces of brick or stone foundations. He simply cuts off all chances for this communication by inserting a sheet of galvanized iron, or "termite shield" as he calls it, into the masonry and turning the projecting edges downward at an angle. A variation of the method, which he states has been used in Africa, consists in placing metal caps over the tops of construction pilings.

Scented decoys for the deadly tsetse fly are now employed in up-country districts by government entomologists. In order to trap and destroy the insects which cause sleeping sickness, dummy animals are being erected upon which the flies light with the intention of biting the animals. If animal odors cling around the dummies the flies will linger about until killed. Images of donkeys with brown paper legs are commonly employed.