PHYSICS

Element 101 Discovered

Mendelevium, the heaviest and rarest form of matter known, has been produced in the University of California's cyclotron. Identity based on only 17 atoms of new element.

➤ THE DISCOVERY of element 101, the heaviest and rarest form of matter on earth, has been achieved at the University of California by modern nuclear science.

The new element is a kind of "dinosaur" of the physical world. It existed at the birth of the earth, but like other elements heavier than uranium it sputtered and "died" out early, transforming itself by radioactive decay into lighter elements.

The brief regeneration of the long-extinct form of matter in the Berkeley 60-inch cyclotrons is an exciting chapter in physics.

Only 17 atoms of the new element were identified—an amount of matter that's invisible, unweighable, almost unimaginably small. Probably no form of matter has existed in such small quantity for nearly five billion years—since the birth of the earth.

The discoverers are members of a famous Berkeley science team who have been element-hunting successfully for over a decade. Their triumphs include the discovery of plutonium, fuel of nuclear energy. They are Drs. Albert Ghiorso, Bernard G. Harvey, G. R. Choppin and S. G. Thompson, research chemists, and Dr. Glenn T. Seaborg, leader of the team and a Nobel Laureate. The research was sponsored by the Atomic Energy Commission.

Dr. Ghiorso reported the discovery at the American Physical Society meeting in Washington.

Fissions Spontaneously

Dr. Ghiorso said element 101 has been given the name mendelevium (chemical symbol Mv), in honor of the great 19th century Russian chemist, whose periodic system of the elements is known to every student of high school chemistry. Mendeleev's system has been the key to the discovery of elements for nearly a century.

Mendelevium is intensely radioactive, decaying by spontaneous fission. Its half-life is between a half hour and three hours. It has chemical properties similar to those of thulium, element 69, a rare earth.

The new element has no direct practical value in atomic energy. But like the other transuranium elements, it will help broaden our understanding of matter and of the history of the earth.

Dr. Ghiorso said the big problem in making and identifying the new element was the infinitesimal quantity of matter involved. The experimenters had to "build" element 101 out of a starting material too small to see—about a billion atoms of element 99, another cyclotron-made synthetic form of matter.

To have any hope of detecting the presence of 101 atoms, the famous 60-inch Crocker cyclotron had to be "souped up." Methods were devised to deliver an extraordinarily intense beam of alpha particles to a very small area (1/32 by ¼ inch)—some 30 trillion alpha particles, the nuclei of helium atoms, passing through this space each second during bombardments. Drs. G. Bernard Rossi and Joseph G. Hamilton of the Crocker Laboratory performed these bombardments.

Water and helium were used to cool the target, because of the thermal heat generated by the bombardment.

Dr. Ghiorso and his colleagues electroplated their element 99 atoms (mass number 253) on the back of a thin gold foil. When alpha particles passed through the foil and smacked an element 99 atom with an energy of 41 million electron volts, the atom changed into element 101 and was bounced out of the foil. These 101 atoms were caught on an adjacent gold foil.

After bombardment, the gold-collecting foil was dissolved, impurities were removed, and the residue was separated into different chemical components. The fractions consisted of solutions containing element 99, element 100, and one that could only contain element 101 if it had been made.

Then tests of radioactivity were made of the different samples. The scientists expected to find an element 101 isotope with a mass of 255, decaying by alpha particle emission with a half-life of about five minutes.

At first they found nothing significant. Then in one of their experiments they recorded two spontaneous fissions in the 101 fraction. Repetition of the experiment consistently yielded the same result. They found the element has a half-life of from a half-hour to several hours.

Scarcity of the data and the surprising half-life made the scientists skeptical of the data at first. The shortest half-life for a spontaneously fissioning isotope previously reported was 60 days—some 500 or more times longer.

During their experiments, the scientists noted that the element 100 fraction also contained a spontaneously fissioning isotope. This led to an explanation. The scientists suspected they had made an isotope of element 101 different from the one they had sought—an isotope with a mass of 256.

If the strange 101 isotope actually decayed first by electron capture to element 100, and then element 100 decayed by spontaneous fission, the phenomena could be explained.

Off to the Materials Testing Reactor, at Arco, Idaho, the scientists went. They made a batch of atoms of elements 100 with a mass number of 256—which decayed by spontaneous fission with the right half life.

This made everything fit. The identification of element 101 had been confirmed by its chemical properties (separation), and by characteristic radioactivity of its daughter product (element 100, mass number 256).

The scientists say there is still an isotope to be found, of mass 255, decaying by alpha activity.

Science News Letter, May 14, 1955

PILOT FASHIONS—The new look for high altitude pilots is this Air Force T-1 pressure suit sported by test pilot Richard L. Johnson. Rubber tubes along the arms and legs inflate, tightening laces that apply pressure evenly over pilot's body.

AGRICULTURE

Cotton Pests Believed To Hitch Rides on Air

➤ THE PINK bollworm moth, one of the nation's major cotton pests, is believed to hitch rides on air currents to travel across the Cotton Belt. This mode of travel is now thought to be the cause of the pest's continued spread despite a tight quarantine.

Although known to be weak flyers, U. S. Department of Agriculture entomologist P. A. Glick has tapped a dozen pink bollworm moths at altitudes of from 100 to 1,000 feet in 37 flights over southern Texas. One of the high-gliding moths was caught over a desolate area of cactus, mesquite and grass, 15 miles from the nearest cotton field.

Since 1951, the Department reports in *Agricultural Research* (May) the pink bollworm moth has invaded 90 previously free counties in the Southwest.

Science News Letter, May 14, 1955