

field, and their frequency (read for the next half second) indicates its value. The Oxford group got the design as a windfall from Britain's Ministry of Supply. When the instrument was invented in the US, the ministry sought to develop it as a mine detector. The effort failed, but the development work was available when the Oxford archeophysicists wanted to survey an area in a hurry before a road was laid over it. Recently developed is a field model that weighs only 10 kg with batteries.

An adaptation of the proton magnetometer measures the difference between the magnetic field at the ground and that 10 ft in the air by

bucking the signals from two detectors.

**Metals underground** are found with a new instrument. It consists of a transmitter coil, through which 10–20 A is sent for about a millisecond, and a receiver coil at the same position. In the absence of metal the magnetic flux falls as the transmitter current does. But when metals are present, eddy currents induced in them cause a slower falling off.

Several other instrumentation techniques are in use at the laboratory, notably x-ray fluorescence spectrometry, electron-beam analysis and neutron-activation analysis. What started at a dinner-table conversation has grown into a busy activity at Oxford labeled "Research Laboratory for Archeology and the History of Art." —RHE

### Russians See Element 102, Call it Joliot-curium

A rose by any other name would smell as sweet, but would an element? Number 102, officially known as nobelium and occasionally called rutherfordium, has been renamed joliot-curium by a Russian group that suggests that it may be the first actually to observe the element. At the International Conference on Heavy-Ion Physics held at Dubna last October, G. N. Flerov, director of the Dubna Laboratory for Nuclear Reactions, reported that his group had produced five different isotopes of element 102. The new observations disagree with Berkeley measurements in 1958, 1959 and 1961, in which two isotopes of element 102 were reported, and experiments at the Nobel Institute in 1957, which indicated one or two isotopes of 102 had been found.

**Earliest report** of the discovery of

element 102, made at the Nobel Institute by an Argonne, Harwell and Nobel collaboration, came from bombardment of a curium target with 90-MeV  $^{13}\text{C}$  ions from a cyclotron. Experimenters reported they had found  $^{253}102$  or  $^{255}102$ . They observed alpha emission with an energy of 8.5 MeV and half-life of about 10 minutes.

The following year Albert Ghiorso, T. Sikkeland, J. R. Walton and Glenn Seaborg used the new Berkeley HILAC (Heavy Ion Linear Accelerator) to produce  $^{12}\text{C}$  ions at energies from 60 to 100 MeV. They reported  $^{254}102$  had been found, with a half-life of 3 sec. Element 102, traveling on a conveyor belt, emitted alpha particles; the recoiling daughter atoms of  $^{250}\text{Fm}$  were collected by a catcher foil. To confirm the existence of element 102, fermium was chemically

identified. In 1959 the group found an isotope with a half-life of 3 sec and an alpha-particle energy of 8.2 MeV as well as spontaneous fissions with the same half-life. In 1961 the group reported a second isotope  $^{255}102$ , with an alpha-particle energy of 8.2 MeV and a half-life of 15 sec. The Berkeley group was unable to duplicate the results obtained at the Nobel Institute.

Ghiorso, commenting on the Dubna claim, says, "We do not agree that they have prior claim." His group has repeated its experiments with the HILAC, which now has greater intensity, and expects to publish new results shortly.

**Dubna discovery.** Flerov's large group used the two Dubna heavy-ion cyclotrons, 300-cm and 150-cm, to produce, over the last six months, five isotopes of element 102. The cyclotrons produced ions with 7 or 8 MeV/nucleon. To make element 102, either oxygen ions bombarded plutonium or nitrogen ions struck  $^{243}\text{Am}$ . As in the Berkeley experiments, a conveyor belt and catcher foil were used to isolate daughter atoms. Reaction cross sections are an order of magnitude smaller than in the Berkeley work.

The Dubna group found isotopes of joliot-curium from 252 to 256, inclusive. Results appear in the table.

Flerov is currently searching for isotopes of element 105 by hitting americium targets with neon ions from the 300-cm cyclotron. He plans to increase ion energies from the 150-cm cyclotron to 15 or 20 MeV/nucleon and then search for  $^{278}114$ , which may be the most-stable very heavy nucleus, according to some heavy-ion experts. In 1964, Flerov's group reported the discovery of element 104, which has been named kurchatovium.

Another Soviet heavy-ion cyclotron is operating at the Physical Technical Institute in Leningrad, where I. C. Lemberg is doing coulomb-excitation studies with nitrogen, oxygen and carbon ions. And at the Kurchatov Atomic Energy Institute in Moscow, where A.A. Oglogblin is director of the cyclotron laboratory, there is a 150-cm cyclotron that accelerates helium, lithium, carbon and nitrogen ions. The lithium beam is regarded as the best now available anywhere for spectroscopic studies. —GBL

Decay Processes for Element 102

Isotope	Alpha-decay energy (MeV)	Half-life (sec)	Branch for spontaneous fission (%)
252	8.41	4.5	—
253	8.01	95	—
254	8.11	75	—
255	8.08	180	<0.01
256	8.41	8	<0.65