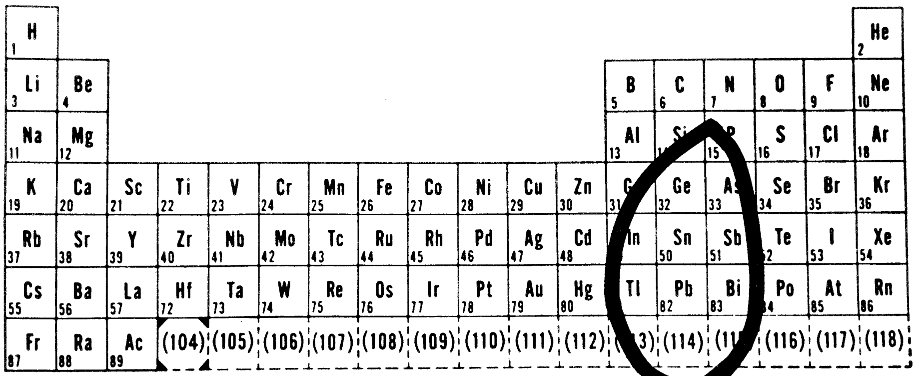

AEC

The neat lineup of tin, lead and 114: a "good omen" for the transuranics.

star of hope, around 114 protons to 184 neutrons." Here and also at proton number 110 is where much of the current action is concentrated, and the hope, as Prof. Nilsson points out, is international. As AEC chairman Dr. Glenn T. Seaborg points out, lead and tin, two stable elements, occupy the same column in the periodic table as element 114.

"The nucleon magic numbers are all in line," says Dr. Nilsson, ". . . a very good omen."

Scientists at the Lawrence Radiation Laboratory got "really quite excited last summer" about looking for element 110, says Dr. Stanley Thompson. Later, realizing that 114 was an even better bet than 110, they began looking for both. Some of the half-lives of magic number elements in this range can be quite long, says Dr. Thompson; the hypothetical element with 110 protons and 184 neutrons should have a half-life of 100 million years.

Lasting as long as that, element 110 might appear in nature, the Lawrence scientists reasoned. Since it should have chemical properties similar to platinum, they looked for it in association with that metal in platinum ores. If it is there, they find, it cannot be more abundant than one 10-billionth of the amount of platinum. X-ray spectroscopy and bombardment of targets with heavy ions have also failed to find either element 110 or 114.

The Lawrence group is now trying to get two-billion-year-old platinum from a South African mine in the hope of finding fission products of 110 in it. The negative results so far are not a contradiction to theory, says Dr. Thompson; "we were hoping nature would be more generous than the theoreticians."

Meanwhile, the theoreticians in their speculations are running far beyond atomic weight 300. There is no reason why magic numbers should stop at atomic weight 250 or even 500, says Lawrence's Dr. W. J. Swiatecki. He would like to be able to accelerate and bang together uranium or plutonium nuclei to check on what happens to them.

Furthermore, in Dr. Swiatecki's view, there is a possibility of super-sized macronuclei. If one hypothesizes putting together a nucleus out of thousands of neutrons and protons, unusual things —such as bubbles—could happen to their shape and structure that would permit them to be stable.

"Atomic number 14,000 might in principle be stable," says Dr. Swiatecki, and he speaks of a possible nucleus a millimeter wide that would weigh 10 tons.

COAL CONVERSION

Into the pilot stage

Until World War II, coal and oil had been like two long-lost relatives. Born millions of years ago of the same parents—heat and pressure—they had little to do with each other. Then critical shortages forced German scientists to attempt to find a way to make oil from coal. They succeeded, but the product was expensive.

After the war, a combination of an oil-thirsty America and dwindling petroleum reserves compelled U.S. scientists to join the effort in earnest. Since coal and oil were both derived from primeval organic matter and since they are both essentially composed of hydrogen and carbon—coal has less hydrogen—it was natural that chemists try to convert the more plentiful coal into the scarcer oil.

The U.S. Office of Coal Research in Washington estimates that there is enough coal underground to meet United States' petroleum requirements for the next 200 to 300 years, while new oil reserves are becoming more difficult to find. Present figures show four times as much coal as oil, oil shale and gas in underground reserves.

Although processes have been worked out for the conversion of coal to oil and some tried out in pilot plants, none has proved economically practical. But last week the Department of the Interior announced that it has approved a final report for a process for making oil from coal. The announcement marks the end of the research stage for the long-sought conversion.

The next step is the construction of a pilot plant, followed by commercial production. That is hopefully expected to begin around 1975, about five years after the completion of the pilot.

The process chosen begins with a coal-oil combination in suspension.

The solid coal particles are hydrogenated directly by adding hydrogen gas at a total pressure of about 3,000 pounds per square inch at 800 degrees F.

At this point, an oily liquid is obtained from the coal. However, not all the coal is converted. The unconverted coal is burned to make steam, which provides heat for the other processes.

The liquefied coal then goes through a distillation process, where the less volatile products are separated in a distillation column like those used in an oil refinery. These less volatile fractions are further refined by hydrocracking to produce gasoline, jet fuel, fuel oil, furnace oil and diesel oil. The more volatile products of the fractionation are blended back into the end products.

This process represents one of three basic processes used to convert coal to oil. A second process involves the preparation of an extract first and then hydrogenation of the extract. The third process is carbonization (heating coal without air) and then hydrogenation. Of the three, the direct hydrogenation appears to be the most efficient.

The Office of Coal Research estimates that the first coal-to-oil refineries will probably turn out 100,000 barrels of oil a day. Over a year's time this would amount to 33 million barrels, distilled from 11.5 million tons of coal.

Presently, 10 million barrels of oil are refined in the United States each day.

Therefore, one such coal-to-oil refinery could account for one percent of the nation's refining capacity.

The cost of the first refinery is expected to run between $300 million and $425 million, depending on location and the products manufactured. The refinery would produce gasoline for an estimated selling price of $5.04 a barrel, a price that compares favorably to present rates. About 35,000 tons of coal a day would be needed by such a plant.