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A Massachusetts Institute of Technology engineer who directed the research that led to the first continuous commercial production of uranium received the country's top mineral engineering award last night.

Because of the work of Dr. A.M. Gaudin, Richards Professor of Mineral Engineering at M.I.T., mineral men can now also recover uranium from large quantities of ores many times leaner--some up to a hundred times leaner--than had previously been thought possible.

The M.I.T. work helped lay the basis for uranium processing in the United States and the value of the industry that sprang from the research is measured in the hundreds of millions of dollars.

For his achievement, Dr. Gaudin received last night the distinguished Robert H. Richards award at the annual meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers in New Orleans.

Gaudin Award

The story behind the award had long been classified. And just how poor an ore can be processed economically has still not been published. But it is known that in some ores currently being processed only a few hundredths of one percent of the ore is uranium.

"We used to throw away more uranium," says Dr. Gaudin, "than we now have to start with in some instances."

"The low-grade South African ore on which the M.I.T. group did

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their research," he adds, "was once viewed largely as a mineralogical curiosity and not as the great natural resource which this work made it."

Because of the M.I.T. research, which was sponsored first by the Manhattan District and later by the Atomic Energy Commission, the processing of uranium is now South Africa's second industry.

One fundamental part of the new process involves leaching, a method which had never before been applied to uranium on an industrial scale. It is now used everywhere in the recovery of uranium from low-grade ores.

Another aspect of the research developed the use of ion-exchange resins for extracting the uranium from solution. This was an entirely new technique for the mineral industry. It was the success of this approach which made possible the processing of the low-grade South African ores.

The initial results on low-grade uranium ore were achieved at M.I.T. under Dr. Gaudin's direction with the effective cooperation of laboratories in England, South Africa, and elsewhere. It was carried on later by the American Cyanamid Company and similar work is being done today by the National Lead Company in Winchester,Mass.

The work began during World War II when the Manhattan District, which developed the A-bomb, asked Dr. Gaudin to head an M.I.T. team to investigate ways of getting uranium out of low-grade ores by flotation methods. They came to Dr. Gaudin because he is one of the world's leading authorities on flotation, a method of separating solids with bubbles.

But Dr. Gaudin himself didn't want to be limited in his investigations to a single method. He asked for a carte blanche ticket--

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and got it. And it's just as well he did, for the final successful process had nothing to do with flotation.

The first step in the new process is the leaching of the uranium ore in sulphuric acid. This involves taking the uranium out of the ore in much the same way you might separate sand and sugar by passing water through the mixture.

Dissolving the uranium from low-grade ore into the cold sulphuric acid is fairly straight-forward. But getting it out of the acid is something else again.

Early in the M.I.T. study, the suggestion was made that ion-exchange resins could be used to take the uranium out of the sulphuric leach. Ions are electrically charged particles; the resins, which are used, are like little beads of jelly beans.

"Chemically," says Dr. Gaudin, "the resins act like three-dimensional coat hangers in which all the hooks are occupied by charged particles or ions willing to trade places with less stable ions. There are even resins, as we know now, which have a preference for uranium ions."

When the resin is saturated with uranium, a new solution called the eluant is passed over the resin bed. The eluant reverses the process and removes the uranium. The pure metal is then readily recovered.

In developing their process, Dr. Gaudin's group--for sound scientific reasons--worked first with positively charged or cation resins. These resins extracted the uranium in grand style. But they also extracted so much iron and aluminum and other metals from the leach that nothing much was gained by the process. In fact,

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results with the cation resins were so disappointing that the approach was dropped.

The big break eventually came in a report published by Batelle Memorial Institute (Illinois) where work was being done on another aspect of the uranium problem. The Battelle workers found that uranium could be taken selectively from sulphuric acid solutions by negatively charged or anion resins.

This report was received by the M.I.T. group with great excitement. It meant that their original ion-exchange research had been on the right track and that they only needed, as it were, resins of the opposite sex. Immediately, as Dr. Gaudin recalls, "we dropped everything on an hour's notice and proceeded to investigate anion resins." They worked--and a new uranium industry was born.

Dr. Gaudin and his group also contributed two other significant ideas to the development of the new uranium extraction industry. They are RIP and SIP.

RIP, or resin in pulp, is a way of avoiding the difficult and expensive need for separating the pregant uranium liquor from the waste solids which follow the leaching operation.

In actual practice, the spent liquor and waste come out at the end where the fresh resin bead goes in. And the uranium-rich bead emerges at the point where the raw leached pulp arrives. There are a number of RIP plants in operation today and others are under construction.

SIP, or solvent in pulp, is a similar step-saver in the solvent extraction method which is applied to the processing of some low-grade uranium ores.

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This is the story behind the award. It is the story of the birth of a new industry. But it isn't the end of the story.

"Mineral men," says Dr. Gaudin, "may get a promising new low-grade ore tomorrow that because of its make-up will demand that we meet new problems and solve new combinations of difficulties."

"And at any stage of the game," he added, "we are always striving for something better."

Robert H. Richards, whose name the award to Dr. Gaudin commemorates, graduated from M.I.T. in 1868 in the Cambridge institution's very first class. Professor Richards was world-renowned for his knowledge of mining engineering and, especially, for his pioneering work in ore dressing.

Dr. Richards was for more than forty years head of the department of mining and metallurgy at M.I.T., and was one of the founders and first president of the M.I.T. alumni association. Retiring as professor emeritus in 1914, he lived for another thirty years and was over a hundred when he died in 1945. The Richards chair at M.I.T., which Dr. Gaudin currently holds, is named in his honor.

Dr. A.M. Gaudin has an international reputation and the citation accompanying the Richards award to him praised "his contributions as a scientist, educator, and author" as well as his "leadership and direction in the development of leaching and recovery techniques for low-grade uranium ores."

The son of a distinguished French engineer and the grandson of a pioneer crystal chemist, Dr. Gaudin took his bachelor's degree in France and his E.M. degree at Columbia University in 1921. Before

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joining the M.I.T. staff in 1939, he had held posts at the University of Utah and at the Colorado School of Mines.

While Professor Gaudin is perhaps best known for his contributions to the theory and practice of flotation and for his books "Principles of Mineral Dressing" and "Flotation," his interests have embraced such diverse fields of inquiry as hydrometallurgy, ion-exchange, solvent extraction, and the metallurgical applications of radioactive isotopes.

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