GENERAL SCIENCE

Under T.V.A. Controversies Lies Much Science Research

Great Mass of People and Wide Area Touched By Production of Cheaper Phosphate Fertilizers

BURIED beneath the charges and counter-charges in the current controversy over the administration of the Tennessee Valley Authority is much good science and technology which may come to light in the apparently imminent Congressional investigation.

There is the construction of giant dams designed to control floods and provide navigation on the Tennessee River and huge power plants to supply electric power to a great area. Of the economic controversy over public utilities versus private utilities much has been said. And even more will probably be said when the investigation of Congress into T. V. A. really gets under way.

But, steering clear of the economic and political aspects of T. V. A.'s current troubles, there is much science of fundamentally wide importance. In particular there is the question of phosphates and the technological advances of phosphate production, to which scientists of T. V. A. have contributed. President Roosevelt has promised Congress a special message on the importance of phosphate production.

In fact, phosphate fertilizers represent, perhaps, the nearest point at which the work of the Tennessee Valley Authority touches the greatest mass of people in the nation.

Wider Area Affected

Flood and navigation control on the Tennessee River and the areas which can use T. V. A. power represent only a small region of the nation, compared with the wide distributional area which can be touched by T. V. A. activities in the production of phosphoric acid, phosphate fertilizers and other products requiring a compound of elemental phosphorus.

Government scientists at T. V. A. have worked toward the goal of making cheaper phosphates by improved techniques coupled with low-cost hydro-electric power. Cheaper fertilizers for the nation's agriculture is one immediate prospect of this research.

A bit farther ahead in the future may be the day when the lessons learned at T. V. A. will enable the great western power projects at Grand Coulee and Bonneville to supply cheap electricity which can turn the phosphate rock deposits of Utah, Wyoming, Idaho and Montana into usable resources instead of prospect holes and deposits now marked only on the maps.

At present, large-scale commercial production has been attained only in Florida, Tennessee, Idaho and Montana, with some lesser output from South Carolina, Kentucky, Arkansas, and Utah.

The source of raw material for existing commercial operations is rock phosphate which, geologically, represents man's harvesting of a by-product of animal life in prehistoric ages. Rock phosphate, many geologists believe, contains phosphate released in the disintegration of the bones, tissues and excrement of prehistoric animals. Some of the profitable Florida deposits seem to be the result of the leaching of guano.

Phosphorus Cycle

The life cycle of animals, in fact, is an interchange of the placement of phosphorus in the earth. Plants take the phosphorus from the soil, man and animals eat the plants, and each other, and store the phosphorus in their bones. At death, these bones and their contained phosphorus are returned to the soil.

Thus, in the life cycle of modern civilization, the shifting of phosphorus is through a sort of giant funnel. The phosphorus is collected from all the farms of the nation and ends up in sewerage or in the bones of man and animals. The bones of animals are partially reused to supply more phosphorus and its compounds. The phosphorus in human bones eventually comes to rest in the cemeteries of the nation.

The history of phosphate manufacture has its origin in the burning of the bones of animals. This bone ash, as it is called, is considerably purer than mineral rock phosphate, as one would expect. Such bone ash, even today, goes into the producticn of phosphoric acid and the compound monocalcium phosphate for baking powder, as far as its limited supply allows.

One of the commonest ways of making phosphate fertilizers is to add somewhat dilute sulfuric acid to ground rock phosphate. One pound of the former plus a pound of the rock produces about two pounds of ordinary phosphate fertilizer carrying from 16 to 18 per cent. phosphorus pentoxide (P_2O_5). The pentoxide is the standard way of rating fertilizers for their phosphorus content.

But phosphorus and phosphoric acid can be produced, without sulfuric acid, by heat treatment. And there is where T. V. A.'s cheap electric power comes into the picture, because except for the technical difficulties involved, it matters little what the source of heat may be. T. V. A. engineers have employed electric furnaces and, through the years, ironed out many of the difficulties of electric furnace operation in phosphate manufacture.

The Process

Under the direction of Dr. Harry A. Curtis, chemical engineer at Muscle Shoals, T. V. A. has been making phosphates by mixing rock phosphate, coke and silica pebbles in electric furnaces. Elemental phosphorus, carbon monoxide and calcium silicate are the three products resulting.

Later the phosphorus is burned, or oxidized, and then washed with water to produce phosphoric acid. The by-product, calcium silicate, may be blown into fibers and used as rock "wool" for insulation purposes. The phosphoric acid is combined with rock phosphates to make the commercial fertilizer.

Another variation of the electric furnace method of making phosphate fertilizers starts in the same way in producing phosphorus, carbon monoxide and calcium silicate but the first two are burned together and the resulting gas combined with phosphate rock as the fertilizer. This product can be hauled in open gondola cars without deterioration. The soil solution finally makes the phosphorus of this fertilizer available to the plants.

Recent conferences have been held in Idaho to discuss the great phosphate deposits in the western states. The rock is of high quality but the expense of shipping it to distant points for conversion into fertilizers has prevented its extensive exploitation in the past.

There are two possible ways these western deposits might be made commercially profitable. Either cheap electric power in large quantities could be purchased from government-owned hydro-electric plants in western areas, or the great resources of oil shale, very near the phosphate deposits, might supply cheap fuel. This shale oil cannot be produced profitably and shipped any great distance by processes known today. But if the oil were used at the phosphate smelting plants, nearby, perhaps the project could be worked out. All this, however, is for the future. A more immediate possibility is the use of coal available within 25 miles of the phosphate field. At Anaconda natural gas is available at a very low price.

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GEOLOGY

Crystals in Antarctic Rocks Revise Geologic Theory

GRIMY, greenish-gray rocks, broken from the ice-carved, windswept slopes of an extinct volcano in the almost unexplored Raymond Fosdick Mountains of Antarctica by Dr. Thomas C. Poulter, senior scientist of the second Byrd Antarctic Expedition, may increase our knowledge of how rocks are formed.

Reporting the results of a study of these rocks to the Geological Society of America, Dr. C. N. Fenner, rock expert of the Carnegie Institution's Geophysical Laboratory, in Washington, finds that old ideas of rock formation need to be reviewed.

Until recently, it was believed that molten rocks deep under the earth's crust resembled basalt, a dark heavy rock, of which the Palisades of the Hudson, the Giant's Causeway in Ireland, and other famous clifflike structures are made. As these molten rock masses came near the surface, certain compounds in them crystallized as the rock cooled, leaving other mineral compounds molten until further cooling took place, and changing, as cooling went on, the chemical composition of the remaining molten material.

According to this theory, which has received much support, alkaline materials should crystallize first from a molten rock magma, leaving it more acid than before. The rocks from the Antarctic, however, do not follow the theoretical rules of change, suggesting to the geophysicists that laboratory conditions do not duplicate field conditions very closely, and that tests should be made of the rocks themselves and their minerals, and not of laboratory specimens under simpler conditions than those existing in nature.

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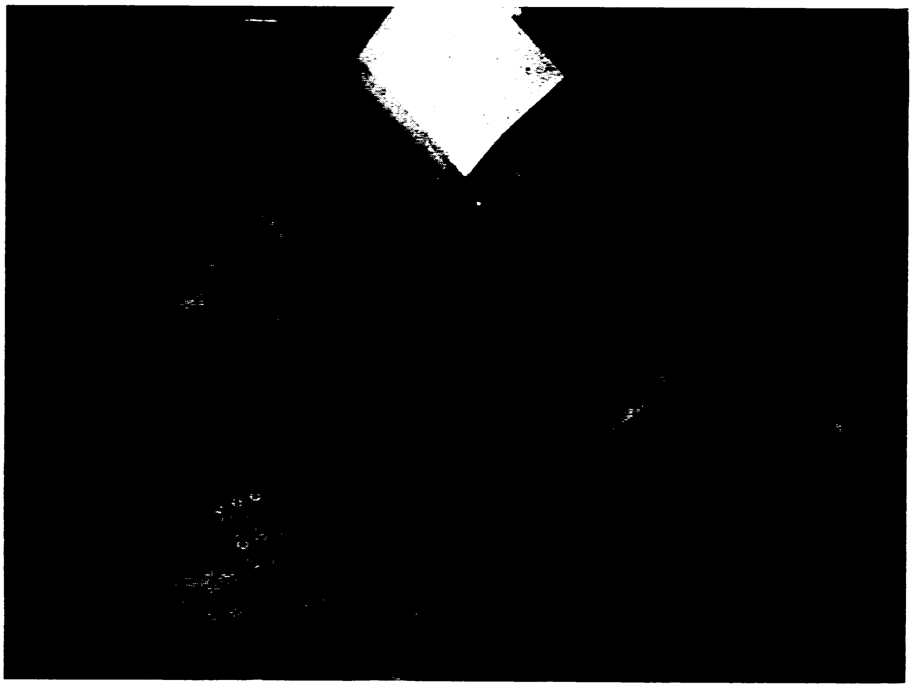

CHILD OF TOMORROW

Now, a reading machine joins the typewriter and adding machine as the latest addition to the gadgets of a "mechanical" education age. This ultra-modern four-year-old looks inquiringly at a page thrown on the screen of Science Service's machine for reading books recorded on microfilm. Libraries and scholars are using microfilm in increasing numbers to record on a few feet of film books and manuscript that would otherwise take up tremendous space.

PHYSIOLOGY

Night Blindness May Be Cause of Auto Accidents

UNTOLD numbers of children in America are today eating spinach, not because their parents tell them "It's good for you," but because a popular animated cartoon character performs prodigious and fabulous feats on the motion picture screen after partaking of this green vegetable.

With the merits to children a matter for the nutrition people to decide one can go on and add, however, that it might produce a more immediate and beneficial result for the country if the parents—and not the children—ate the spinach, or plenty of green and yellow vegetables.

The reason is that these vegetables contain vitamin A. It is now found that the lack of vitamin A can be one of the causes of "night-blindness" which is recognized as a major factor in night accidents in driving.

Night-blindness is the failure of proper regeneration of the chemical known as visual purple which is found in the retinal rods of the human eye. This visual purple is rich in vitamin A.

Glaring headlights produce temporary blindness lasting a second or two in a person with normal vision. In a person with night-blindness this effect, due to glare, lasts appreciable lengths of time. And, in a motor car travelling at a high rate of speed, a night-blinded person may have travelled several hundred feet in which control of the car is more by habit than by visual knowledge of road conditions ahead. There is no known cure for night-blindness, say physicians, but a liberal supply of vitamin A may, at least, give the eye the material it needs to prevent the onset of this condition. Do I hear little Johnny saying, "Pop, you better eat your spinach?"

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