SCIENCE NEWS

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LOESS AND THE FARM LANDS OF THE UNITED STATES

SOME of the best farm lands in America are the product of unimaginably violent dust storms—dry, gray blizzards that howled off the edges of the vast glacial sheets of the Pleistocene Ice Age. They are the wind-deposited soils known technically as loess, that are found over wide stretches of the Midwest and also (though more thinly deposited) in parts of the East.

Wind has long been credited with the creation of the loess, but there have been many things about this soil type that have puzzled geologists. New light is thrown on the problem by Professor William H. Hobbs, of the University of Michigan, as a result of long studies around the ice sheet that covers Greenland—one of the two places on earth where Ice Age conditions still persist.

During Greenland's short but often surprisingly warm summers there is very rapid melting around, and just within, the glacial margins. Heavy floods of water, turbid with suspended mud and sand, pour out, frequently floating off blocks of ice with boulders embedded in them. These eventually become stranded and melt, dropping their boulder loads at considerable distances from the edge of the main ice mass. Geologists know all this solid discharge from under the glacier edge by the vivid name of "outwash."

When the long winter sets in, bitterly cold winds, at velocities of a hundred miles an hour and more, pour down off the interior of the ice sheet. The outwash is soon dried out, and the lighter particles blow outward in great clouds. Sandstorms at lower levels, dust storms at all levels, rule the season. Except for temperature, conditions are not unlike those encountered in the Libyan desert. Exposed stone surfaces are sand-blasted in almost exactly the same manner in both regions.

The outward-blowing dust is halted only by vegetation and does not, therefore, settle permanently upon the outwash plain itself. Around the outwash area it builds up a heavy deposit of the loess, which is thickest about the rim of that area and thins out the other ways. Thus it comes about that in the upper Mississippi Valley the loess has been deposited peripheral to the areas occupied by the last ice sheet, but with an intervening area wherever there has been outwash deposited. This distribution of the loess has long been recognized by glacialists, but has never before been explained owing to the failure to take account of the so-called glacial anticyclone over continental glaciers.

Professor Hobbs has found abundant evidence of the same state of affairs in the abundance of wind-sculptured boulders, in the inland sand dunes of Nebraska, and in the distribution of the Midwestern loess which covers whole Corn-Belt counties and piles up in hills as much as 300 feet high along the banks of the Missouri.

FLUID COAL

"FLUID" coal, a pulverized form of coal which, when mixed with air, can be made to flow through standard pipes a quarter of a mile long, is being studied by fuel engineers at Battelle Memorial Institute, Columbus, as a possible substitute for fuel oil in industrial heating processes.

Preliminary work on the application of this finely ground coal to industrial furnaces—which application if widely adopted may have great effect in alleviating shortages of fuel oil—has demonstrated that the fuel is entirely suitable for use in many types and sizes of forging furnaces, that it has advantages of fluidity similar to those of oil and gas, and that it gives flames of high emissivity which provide maximum heat transfer by radiation.

Of particular importance is the fact that for most sections of the country this material would be more economical for applicable industrial processes than the fuels now being used.

Investigations in the uses of pulverized coal have been in progress at the Columbus industrial research laboratory for several years and are now being intensified under an enlarged research program supported by the bituminous coal industry. Emphasis is being placed upon the application of the finely pulverized coal to forging, heat-treating and other metallurgical furnaces, which now consume great quantities of oil and gas in the war industries.

"Fluid" coal is produced by grinding coal to dustlike fineness in specially designed mills. A stream of air entering the mill picks up the fine particles and delivers them to collectors. The material when not impacted will flow through your fingers and pour somewhat in the manner of a liquid. When mixed with air it demonstrates fluid-like properties, will flow through pipes, and spray out of jets.

That the substitution of pulverized coal for oil and gas in some metallurgical processes is entirely practical is verified by the fact that a number of plants have been using pulverized coal for steel-heating furnaces for many years. In fact, in 1920—in the days before oil and gas became cheap—there were 690 known pulverized coal furnaces in operation in this country. The development retrogressed, however, with the discovery of vast new sources of oil and gas and the sharp reductions in the costs of these fuels.

The investigations indicate that there is great possibility of extending the use of pulverized coal to hitherto unexplored fields. It has been tried in the radiant-tube furnace, which is used in heat-treating, annealing, and enameling, with promising results. The successful application of pulverized coal to this type of furnace would remove the principal disadvantage of coal in refined metallurgical work, namely, the fly ash, cinder and sulphur, since combustion takes place inside alloy-steel tubes lining the walls of the furnace.

Finely pulverized coal ignited in air burns rapidly, releasing great quantities of energy. A part of the Battelle investigation of this fuel, but one having less immediate application in industry, is the study of a direct means to harness this energy.

THE CHEMISTRY OF THE HIGH POLYMERS

DR. H. MARK, professor of organic chemistry at the Polytechnic Institute of Brooklyn, speaking before the North Carolina State College chapter of the Society of Sigma Xi, stated that the difference between a springy rubber-like substance and a hard plastic or a tough fiber, either synthetic or natural, lies in the tendency for the molecules of these substances either to contract or to form crystals.

The more crystallization in its structure the more the substance becomes a typical fiber, such as nylon, silk, cotton or rayon. If the mutual attraction between the chain-like molecules of a given material is low, then it will show mainly the properties of an elastomer such as rubber, Buna S, Neoprene, Hycar, butyl rubber, etc. This is also true if the molecules do not fit well into a regular three-dimensional lattice structure. In between these extremes, the substance will show the properties of a plastic, such as hard rubber, methacrylate (lucite), vinylite, polystyrene or ethyl cellulose. Present experimental knowledge shows that all these substances have about the same fundamental structure, but it is their ability to crystallize that gives them different properties.

All types of what the chemist calls "high polymers," whether they be rubbers, plastice or fibers, have the same high order of polymerization, that is, their molecules are composed of about 2,000 or more atoms. "Polymerization" is the name that the chemist gives to the process of making big molecules out of little ones. Either by natural processes or by the skill of the chemist's reactions, simpler materials are built up into more complex ones to form our most useful rubbers, plastics and fibers. These are molecules in which the atoms are visualized as being in a long chain.

"During the past fifteen years," Dr. Mark said, "a new branch of organic chemistry has been started and gradually developed. This is the chemistry of the high polymers. The natural products belonging to this class of substances, for example, cellulose, starch, proteins, chitin, rubber, etc., have been known for a long time, but it was only recently that successful attempts were made to elucidate their molecular structure and to realize their common fundamental building principle. Synthetic products of resinous character built up from small molecules, such as formaldehyde, ethylene oxide, vinychloride and styrene, have also been known for some time, but again their molecular structure and their fundamental relationship with the natural high polymers were not known until about ten or fifteen years ago."

ITEMS

COLCHICUM, the plant that produces colchicine, is not immune to the effects of its own drug, is indicated by experiments by Dr. Ivor Cornman, of the University of Michigan. Since colchicine produces the sudden evolutionary changes in plants that have made it famous in recent years by a partial checking of cell division, giving new cells two or more times the normal number of heredity-bearing chromosomes, Dr. Cornman made his tests simply on cell division in root tips of two species of Colchicum. Weak colchicine solutions had no effect, but when the strength was stepped up to 2.5, 5 and 10 per cent. the cell-division process was seen first to be hindered, then blocked altogether. Since there is always colchicine in the tissues of Colchicum, the question naturally arises, how can cell division go on at all? Why doesn't the plant make itself extinct with its own poison? Dr. Cornman doesn't undertake to answer. He merely remarks that the immunity must be found somewhere else than in the plant's mechanism of cell division. Details of the research are reported in the *Botanical Gazette.*

How cattle and sheep are aided by bacteria in digesting the crude fiber of the grass and fodder they eat has been demonstrated by a new technique devised by F. Baker, of the Guilford County Technical College, England. Mr. Baker's method is described in a statement from the Science Committee of the British Council. Partially digested materials are removed from the animals' digestive tracts either in the slaughter house or from specially prepared surgical openings in living specimens. Under the polarizing microscope, differences in light direction through the materials indicate digested and undigested parts. The role of the bacteria is indicated when iodine is added. Where the bacteria are active, purple spots show the presence of starch-like substances, formed within the bacterial cells out of the cellulosic materials in the crude fiber. Apparently it is this bacterial starch that actually furnishes the nutrition to the animals.

COLOR changes in the test tube will enable chemists to measure amounts of the silver-white metal, palladium, in solutions as dilute as 1 in 300,000,000 parts. The method was developed by Dr. John H. Yoe and co-workers at the University of Virginia. This is the first procedure to be discovered which will detect such minute traces of the metal. It will be useful in analyzing and studying the platinum group of metals and their alloys. Palladium is used in dentistry, jewelry and to speed certain chemical reactions. A new color method for detecting traces of iron as small as one part in 75,000,000 was also discovered. Analysis by weighing, rather than a color change, is the final step in a procedure to test tungsten ores and steels, an important metal in war production. These investigations were part of a research program being conducted by Dr. Yoe and his associates to discover new and more sensitive organic analytical solutions for detecting and determining amounts of chemical elements and their compounds. Such studies have important applications not only in chemistry, but also in medicine and biology.

EXPERIMENTS performed by Professor E. H. Hughes and R. L. Squibb, of the University of California College of Agriculture, indicate that pigs as well as people need vitamins. The newest need on the porcine diet list is pyridoxine, member of the vitamin B complex also known as B_6. Lack of this compound caused a number of distressing (and costly) symptoms, including loss of appetite, poor growth, fits and anemia. Normal health was restored by daily doses of a mere pinhead quantity of pyridoxine—five milligrams per hundred pounds of pig.