THE WORLD'S RICHEST MINE

By Ross L. Holman

The earth's most fabulous mine is the ocean. It is chock-full of precious metals and chemicals for which a ration-mad world is starving. It would require only a trickle of its vast resources to break bottlenecks by the dozen and priorities by the score.

This estimate of sea wealth is not the fantasy of a crackpot dreamer, but of highly responsible chemists. Some of the finished products manufactured out of the briny deep are already in wide commercial production and the demands of war are stepping up the output at a greatly increased rate. Sea water contains gold, silver, radium, iodine, salt, bromine, chlorine, copper, calcium and many other elements. A great variety of sea weeds, known collectively as algae, contain still more. The problem of getting these untapped treasures into the service of humanity is no longer one of discovery, but of chemical skill. Unlike earth mining you don't have to go prospecting all over the ocean's wide expanses for the wealth you are seeking. Each gallon of sea water has just about as much of it as any other gallon.

While it wasn't the first product to which sea water gave birth, magnesium has captured the spotlight as one vital wartime metal that the ocean raised from a condition of scarcity to one of superabundance. Before the first World War, Germany supplied all the magnesium we needed and we needed mighty little. During that conflict the Dow Chemical Company made from its Michigan salt wells the first magnesium manufactured in this country. Up to recently such amounts of this metal as we used came from the ground, but chemists now say that it can be processed from sea water with much less effort because it eliminates the need of washing it from the dirt. The magnesium

ROSS L. HOLMAN *is a Tennessee farmer and comes from a long line of farmers. He finds enough time to follow closely the major scientific advances and to write about them for the magazines.*

needs of World War II have pushed our prewar production requirements into a demand of astronomical proportions. We use 180 pounds of it in the average airplane to replace 270 pounds of aluminum. Still more of it goes into star shells, signal flares, tracer bullets, incendiary bombs, and what have you. Chemists estimate there are 5,700,000 tons of this metal in each of the ocean's 320,000,000 cubic miles.

Down at Freeport, Texas, Dow's plant uses 300,000,000 gallons a day of Gulf water to help manufacture the yearly 400,000,000-pound war and civilian demand for magnesium. That sounds like a whale of a lot of water to be strained for a little metal, but even at such rate of consumption it will be twenty-six years before we can use up the first cubic mile in meeting our annual requirements. The plant is located on one side of a long peninsula jutting into the gulf. The water is pumped into the plant from this side. After processing it is run into the sea from the other shore of the peninsula so as not to dilute the unprocessed water on the intake side. To get the metal out of this briny liquid requires three steps. You first mix lime water with sea water to convert its soluble magnesium salts into milk of magnesia. The milk of magnesia is then treated with acid to convert it into a kind of molten product called magnesium chloride. This is charged with electric current. This final process yields solid magnesium at one electrode and chlorine gas at the other.

Chlorine gas, by the way, is another sea water product of great potential war value. We can use it to choke the Japs in gas warfare if they start anything funny in that direction.

II

Mining salt from sea water is an old, old story. It has acquired new interest, however, because it gives us by-products of important war and postwar value. Most American manufacturers get their salt from salt wells rather than the sea, but the sea is still the principal source in several maritime countries. Salt is one of the most abundant products of the sea. Like many other mineral constituents it was washed into the great deep by nature's sewer system, the rivers and small streams which drain the earth's landed area. While salinity varies in different parts of its vast expanse, the ocean has an average of 3.5 per cent total salts. The Pacific Ocean alone contains enough salt to put a layer of it a mile deep over the entire United States.

Salt is manufactured from sea water by allowing it to flow into shallow artificial basins along the beaches in the drier sections and letting the sun evaporate the water. The water reaches these isolated ponds through a series of channels. In the processing steps a mother liquor called "bitterns" is recovered, from which are derived potash, bromine, Epsom salts and magnesium chloride.

Salt is also the cheapest and most plentiful source of sodium, chlorine and sodium carbonate. More than 3,000,000 tons of the latter are used each year in the manufacture of glass, soap and paper. Out of a compound of sodium and chlorine we get sodium lye, or caustic soda, used in making rayon, cellulose film, soap and other products.

Probably the most important by-products of salt manufacture used in the war effort are bromine and chlorine, both of which are also by-products of the sea water magnesium plants. Bromine is employed in the manufacture of high octane gasoline. The principal military uses of chlorine, aside from war gases, are in bleaching of cotton linters to make smokeless powder and in making tetrachloride for smoke screens.

Our biggest pile of mined gold is in Fort Knox, Kentucky. Our largest supply of unmined gold is in the ocean. How to make the sea shake loose this metal in paying quantities has intrigued the imagination of scientists and dream chasers for many years. Using electrochemical processes somewhat like those employed in electroplating, the sea has been made to give up its gold, but as yet it costs five times as much to mine sea water for this metal as the extracted gold is worth.

A possibility of reducing the cost of extraction to a profitable level was suggested by Dr. Colin G. Fink of Columbia University. In ordinary electroplating of other metals the metal is deposited on the cathode, the negative terminal. When an effort is made to plate gold out of sea water by this method the invisible colloidal gold particles precipitate so rapidly they fail to collect in the visible crystalline form.

But by using a rapidly spinning cathode instead of the ordinary stationary one you can get a distinctly visible gold deposit. It is the cost of providing the spinning cathode that thus far makes this method unusable. "It is felt that on the basis of this discovery," said Dr. Fink, "we have advanced one step closer to the commercial recovery of gold from sea water."

III

Many of the ocean's chemicals are stored in the 8000 or more species of plants that grow in the sea. Through the processing of marine vegetation scientists hope to recover some of these treasures more easily than from the water itself. We usually apply the term "algae" to marine plant life, though some vegetation is excluded from this general classification. Sea plants under this head have a variation in size comparable with those that grow on dry earth and range from the microscopic diatoms to those of forest tree proportions. They are nourished by the water in which they live and in this way collect some of the sea's chemical materials that science is using and others it hopes to use.

Since the war started, the use of seaweed fertilizer in England has increased at a phenomenal rate. Imports of commercial potash have been cut but seaweed is found to have twice as much potash per ton as barnyard manure. It also has 50 per cent more phosphoric acid, a lot of mineral salts and a small amount of nitrogen. It would be hard to find any product that more completely fills the fertilizer needs of land. Those who harvest it get from one to eight dollars a ton.

Dulse is a marine product that grows among rocks which the tide covers and uncovers. To harvest it you have to snatch it from the rocks between tides and then skidoo until the next tidal intermission. It contains iodine, mineral salts and is good to eat. If you want a mess for dinner put it in a pan and fry it as soon as picked. It has some commercial value and is shipped from one part of the country to the other.

One seaweed that has recently boomed is kelp. It is the prime source of algin, though it has previously been used for potash and iodine. Algin is a kind of sugar product employed as an emulsifying agent in salad dressing, chocolate milk drinks, ice creams, etc. It is extracted from kelp after this weed has been dried, pulverized and treated with alkali.

The most impressive thing about the kelp plant is that there is a tremendous amount of it. It grows from the sea bottom as high as several hundred feet. It is harvested by enormous scissors that clip it within three feet of the surface without injuring it. Harvesting kelp is a big industry and it produces about a half billion dollars' worth of products a year. While sea water itself has lots of iodine and potash, industry finds it easier to process these minerals from kelp after it has collected them from the water. Kelp is also used for paper and insulation.

The biggest war bonanza in marine growths is carrageen. This is a kind of moss that grows on the rocky sea bottom along the Atlantic Coast. For many years people along the carrageen sections eked out a starvation living harvesting this Irish moss at two or three cents a pound. Then, because of newly discovered uses and a shut-off of imports, a man-size boom exploded right in their faces. Food specialists found it had a high gelatin content that could be used in soda fount mixtures. It can provide the base for certain puddings, jellies and syrups. It is also rich in iodine and sulphur.

The price jumped from two cents to twenty-five cents a pound. Towns in the carrageen areas bristled with sudden prosperity. Old men, young girls, boys, fishermen and whole families go out from shore in small boats armed with sacks and forks, wade in water up to their shoulders, and bring in $25 to $30 worth per person at a time. High school boys have sold enough in two summers to pay their way through college.

While we have mentioned only a few of the products extracted from marine vegetation we are just beginning to explore its vast possibilities. One scientist has even learned how to manufacture coal out of it. At the Carnegie Institute of Technology Dr. Ernst Berle announced about two years ago a method of producing coal from seaweeds and certain land products. It takes nature millions of years to manufacture coal, but Dr. Berle can make it in one hour and thus speed up the conditioning process by a few eternities.

IV

We are not only mining the sea for minerals and chemicals but we are going beneath the ocean floor for new worlds to conquer. One of the products we now find there in increasing abundance is oil. Many scientists predict that at the present rate of consumption the supply of petroleum in this country will be exhausted in fourteen years. If oil can be discovered beneath the ocean in the same recoverable quantities as in dry land areas one of our bottleneck anxieties will be eased for generations to come.

So far, our facilities for ocean drilling are sufficient only for shallow areas. If the sea is found to be a rich field for exploration it is reasonable to believe that deep water prospecting will follow. The Russians have extended their Baku oil fields far into the Caspian waters. Many profitable oil wells have been drilled off the shore of California. They were bored at the extreme end of piers stretching into the water. Some of them are drilled slantwise from the shore to reach oil deposits below the ocean floor.

Off the shore of Galveston Bay the Standard Oil Company has drilled several wells. In that bay the company engineers made seismograph surveys of 263,000 subocean acres. The wells were drilled from pile foundations and sunken barges at a distance of one to two miles from shore. Oil slicks have been discovered on the water as far as 100 miles from the shore, which suggests the possibility of new oil fields all over this vast unexplored area.

Another mineral found under the ocean floor is iron. This metal is mined under the sea at Newfoundland by means of a tunnel that extends two miles under the water from the shore.

Besides providing a vast storehouse of raw material for our industrial economy the sea may some day be mined for the electric power to process its own products. Harnessing the force represented by the ebb and flow of tides has long intrigued the imagination of engineers. The abandoned Passamaquoddy project in Maine was an effort in this direction. The failure thus far to bridle tidal energy is due primarily to the fact that most authorities in the field believe a way has not yet been found to do it economically.

It is easy, of course, to overestimate our marine assets, but this vast untapped treasure house is a new hope to a bottleneck world. While we were being plagued with a scarcity of raw materials a bountiful nature has dumped a whole ocean full of them right into our laps. In every cubic mile of sea water are 160,000,000 tons of chemical elements. Included in every cube of water this size are $25,000,000 worth of gold, $60,000,000 worth of iodine, 250,000 tons of bromine, 5,700,000 tons of magnesium — and the end is not yet. The total value of all the materials in that one cubic mile is at least five billion dollars. Multiply that by 320,000,000 and you have a staggering idea of the economic value of the world's biggest piece of undeveloped real estate. Until they can be recovered, however, sea treasures are worth no more to us than gold on the planet Mars.

THE THEATRE

By George Jean Nathan

Romance Yesterday — And Today

The best answer to those younger critics who deride any faintest testimonial to the romantic stage of the past is to be found in the circumstance that when the contemporary theatre seeks to adopt a romantic air it has to borrow it from that very bygone stage. Lacking such romance on its own, it is forced to dig up those musical shows and operettas which induced in the audiences of other days that purple mood which remains ever one of the theatre's most welcome narcotics. It thus is compelled to fall back upon revivals of *Die Fledermaus*, or *Rosalinda*, with its old Strauss waltzes to soothe anew the fancies of later-day audiences; *The Merry Widow*, with Danilo again to sing his Leharian way into the hearts of the vicarious Sonias up in the balcony; *The Vagabond King*, with its consoling tale of a poor poet made proud monarch of France for a day; *The Student Prince*, with its royalty melting before the charm of a little Heidelberg waitress and its melodic tributes to a time that even then had already passed into the recesses of fond recollection; *The Chocolate Soldier*, with its Oscar Straus souvenirs of a jazzless era; and the mythology sung by Offenbach and the blossom-time love sung by Schubert.

While in the way of dramatic quality our theatre certainly indicates a great improvement over the one that our fathers knew and peculiarly relished, it just as certainly in its other branches of entertainment lacks the romantic flavor that our fathers knew and far less peculiarly revelled in. Save alone for the two Jerome Kern exhibits, *Show Boat* and *Music In The Air*, presented respectively in 1929 and 1932, the stage, though it has offered a number of very worthy musical shows, has not provided any which have permeated their auditors with that half-sad, half-smiling, boozy feeling which so often was their grant in a remoter day. An *Oklahoma!* may induce a transitory such feeling when one looks at Lemuel Ayres' Grant Wood-Thomas Benton scenic paraphrases of the sweeping South-