INDUSTRIAL VIRGINIA

RICHMOND

MINERALS IN THE TIDEWATER LANDS

(Continued from First Page.)

in America. Copper deposits of comparatively small commercial value are found here and there along the crest of the Blue Ridge, and to a slight extent on the western slope, but chiefly on its eastern flank. The minerals of chief economic importance are those which occur where the western foothills of the Blue Ridge rise above the level of the Shenandoah Valley. The rocks here are broken and folded, and as a result, iron and manganese deposits have accumulated and are worked with profit at a number of places along the Norfolk and Western Railway, which parallels the contact between the rising slopes of the Blue Ridge and the undulating surface of the great valley.

Considered broadly, the valley region, which lies between the Blue Ridge on the east and the Appalachian Mountains on the west, is composed of a series of narrow valleys and linear ridges, arranged in more or less complex relations. The principal rock types inclue limestone, shale and sandstone. The last is suitable for building material, as is also the limestone, but the chief industrial value of the limestone consists in the fact that it may be profitably employed in the manufacture of lime and, together with the shale, for making Portland cement.

Iron Ores and Slate.

The rocks of the Appalachian Mountains are all more or less folded into arches and basins, and while the same rock types as in the valley occur, they are geologically much younger. The most important mineral features of this section are iron ores in Rich Patch Mountain, which supply a large percentage of the furnaces of the State with raw materials. The limestone and shale are also valuable for the manufacture of Portland cement. The largest cement plant in the State is located in this section, at Fordwick, Va., on the Chesapeake and Ohio Railroad. Adjoining this Appalachian province on the west is the region known as the Cumberland plateau, which is underlain by rocks even younger than those of the Appalachian, and are so far removed from the mountain-making forces which uplifted and bent the formation of the Appalachian that they are nearly horizontal. It is in this last province that the great coal deposits of the State are found. The western boundary of Virginia, however, is such that it only reaches out into this area in the southwestern portion of the State. In that section there is a thriving iron industry, but the ores are obtained from geological formations different from those which occur in Rich Patch Mountain.

The Piedmont plateau region lies between the coastal plane and the Appalachian Mountains. It extends from the eastern slopes of the Blue Ridge to the western margin of the coastal plain. Its width increases from about forty miles in the northern part, where it is traversed by the Potomac River, to nearly 175 miles along the Virginia-Carolina boundary. Most of the rocks in this region are extremely old and have been intensely folded. Some idea of the age of the rocks in this region may be indicated by stating that when they were originally folded they were elevated into great mountainous masses.

The agencies of nature, however, have so cut them down and bevelled them that how they represent but the roots of towering elevations as high, or even higher than the Blue Ridge. In the remnants, or roots, of these ancient mountains are found a greater variety of minerals than in any of the other provinces of the state. In general, the surface of the Piedmont plateau has a general southeastward slope from an average altitude of 1,000 feet along the western margin to from 200 to 400 feet on the east where the plateau rocks pass beneath the coastal plain sediments. The topography of the plateau is that of a more or less smooth, broadly rolling, or undulating, upland of moderate elevation, into which the streams have cut rather deep channels. There is nothing now, therefore, about its surface which indicates that it was once a region of more or less elevated mountain ranges. That it was, however, once a region of mountain ranges is shown by the way the rocks are swelled and folded. Among the more important minerals of this section of the State are the Buckingham-Fluvanna and other slate districts, soapstone deposits, building stones, and, to a less extent, iron, copper and gold deposits, as well as the Richmond coal basin. In this connection it should be added that the coal seams occurring here are interstratified with rocks which are very much younger geologically than the typical Piedmont formations which they overlie.

About the Coastal Plain.

The Virginia coastal plain, or Tidewater province, is the most easterly of the three larger physiographic divisions mentioned. It comprises approximately one-fourth of the total area of the State, differentiated from the higher-lying Piedmont plateau on the west by the character of its rocks as well as by their manner of occurrence and difference in the nature of the surface features of the two provinces. The western limit of the coastal plain is defined by the belt of altered crystalline rocks characteristic of the Piedmont plateau, which adjoins the coastal plain at the fall line of the rivers.

It is because of the marked geological differences between the two provinces that the larger streams, and many of the smaller ones, are marked by falls, or rapids, where they leave the hard rocks of the Piedmont to traverse the softer materials of the coastal plain. From this transition point they always show, too, a very decided decrease in the velocity of their currents eastward. It is for this reason that the name "fall line" has been given to this boundady between the two provinces. Similarly, the coastal plain is known as the Tidewater section for the reason that after leaving the Piedmont, the gradients of the streams are low, and in consequence their waters are more or less affected by the tidal fluctuations of the ocean.

The Tidewater region of Virginia is characterized by broad, level-top stretches of country of low relief. It gradually declines in slope from an elevation of 200 to 300 feet on the west to sea-level on the east. The mineral deposits consist chiefly of unconsolidated beds of sand, gravel, clay and marl, which may be locally hardened either by a cement of iron oxide or carbonate of lime. These indurated or hardened ledges in the vicinity of Aquia Creek and in places southward along the western margin, representing the oldest formation of the Tidewater series, have afforded sandstone suitable for building purposes. While these sandstone beds occur in and form part of the oldest formation of the coastal plain, yet they are millions of years younger than the youngest of the various formations occurring in the Piedmont and in the Appalachian provinces. The Piedmont section of the State was dry land and continued as such for millions of years, while the coast of the ocean was marked by the line which now separates these two provinces.

Dr. Watson has long realized that while Tidewater Virginia contains no such variety of mineral wealth as occurs in other sections of the State, yet nevertheless its mineral resources are important, and, if properly utilized, would add largely to the productivity of the wealth of the State.

Discussing the mineral resources of this region in the State survey offices at the University of Virginia yesterday, Dr. Watson said:

"There occur within the coastal plain region of Virginia numerous deposits of very considerable economic value. Some of these have been, and still being, utilized, while others have scarcely commenced to be developed as yet. Not in a single instance, however, is the production of those materials, which have been made use of, in any wise commensurate with the possibilities. The deposits of clay, sand and gravel, diatomaceous earth, lime and green sand marls are very extensive, and are generally of good grade. The extensive deposits of the lime or shell marls and clay, located directly on deep tidewater, offer large possibilities in the location of plants for the manufactude of Portland cement."

Dr. Watson has discussed at length the economic possibilities of developing the numerous mineral deposits of the Tidewater region in Virginia Geological Survey Bulletin No. 4. This bulletin, entitled "The Physiography and Geology of the Coastal Plain Province of Virginia," was prepared largely, Dr. Watson said, by Dr. W. B. Clark, of the Maryland Survey, assisted by Dr. B. L. Miller, of Lehigh University, and Mr. Edward W. Berry, of Johns Hopkins University. The chapter on economic geology was contributed by Dr. Watson.

The bulletin contains an excellent map of Tidewater Virginia, showing in colors the different materials of economic value found there. There are also a number of excellent half-tone illustrations. A copy may be had on application to the State Geologist if 10 cents for postage be remitted.

Dr. Watson, speaking further on the subject, said:

"Clays have a wide distribution over the Virginia coastal plain region. They are usually of an unconsolidated character and almost every formation in the region contains a deposit of clay suitable for the manufacture of common brick, while others are adapted to making the higher grades of building brick, drain tile, hollow-ware and the cheaper grades of pottery. The amount of clay suitable for making common brick throughout the coastal plain is almost unlimited, and the distribution of deposits is such that brick sufficient for local consumption can be made in almost every neighborhood. It is difficult to understand why these clay deposits have not been more extensively utilized heretofore. It is even more surprising that practically no attempt has been made at any point to make use of the higher grade clays.

"The sand and gravel deposits are extensive. The sands are used for building, molding, as engine sand, and for the manufacture of sand-lime brick. The better grades of sand have been locally used in great quantities for building purposes. Some of the sands are probably pure enough to be used in glass manufacture, although none has been devoted to that purpose so far.

Back to First Principles.

"Diatomaceous earth, also known as silica, infusorial earth, or tripoli, is composed of minute shells of microscopic plants known as diatoms. These organisms lived in the ocean and secreted silica just as oysters secrete calcium carbonate, which is the material that limestone is composed of. It was first reported from the vicinity of Richmond, and for that reason received the name Richmond earth. It is known, therefore, by a variety of names and is widely distributed in the Calvert formation. It has even another name, Bermuda earth, because of its occurrence at Bermuda Hundred, on the James River. The first bed of this earth of any extent found in America was in the Richmond area.

"This bed is known as the Richmond bed, which extends from Herring Bay, on the Chesapeake, Md., to Petersburg, Va., and probably beyond. It is not less than thirty feet thick in places, though very impure at times, grading frequently into layers of clay. The beds now outcrop in great thickness in the embankments along the tracks of the Richmond Locomotive Works and along the side of the valley to the west. On account of its porosity and compactness, diatomaceous earth is used in water filters, and as an absorbent of nitro-glycerine in the manufacture of dynamite. It is readily reduced to a fine powder, the hardness of the individual particles and their sharp edges making it an excellent base for polishing compounds. Its low heat conductivity makes it a valuable ingredient in the manufacture of packing for steam boilers and pipes, and in the construction of fireproof safes. It has been frequently used for the latter purpose. It has also been suggested that it might be used in certain branches of the pottery manufacture, which require on the part of the materials a high melting point and the absence of color.

"The green sand marls contain a considedable amount of a dark green mineral, known as glauconite, which is essentially a hydrous silicate of iron and potash. Where they occur with an admixture of shell marl they may be worked to advantage for use as a fertilizer. Such a marl contains two of the most important constituents in plant growth, namely, potash and lime. Most of the analyses show a small percentage of phosphate of lime, which is even more beneficial as a plant food. It is for this reason that the green sand marls have long been known to be of value as a natural fertilizer. The marl improves both the chemical and physical conditions of the soil. From 60 to 100 bushels per acre should be used on sandy soil, and from 160 to 200 bushels on clay soil.

"Besides serving as a natural fertilizer, green sand marl, which occurs in Tidewater Virginia in enormous quantity, is now frequently used as a base in the manufacture of artificial fertilizer. Most of the green sand marl now dug in New Jersey and Virginia is being so used. For this purpose the marl is dried, pulverized and then shipped to fertilizer plants, where other ingredients are added.

Now As to Marl.

"Probably the most important material included in the mineral resources of Tidewater Virginia is calcareous, or shell marl. This is composed in the main of shells of various sorts. They consist, as is implied by the name, chiefly of calcium carbonate, which, it will be remembered, is also the main constituent of limestone. Upon the application of sufficient heat, both shell marl and limestone can be converted into lime. However, owing to the physical condition of the shell marl, it is not easily burned and can be used for fertilizer purposes to better advantage if it be ground to a powder to about the fineness of flour. The marl beds of Tidewater usually attain considerable thickness and the percentage of lime in them is very high. Analyses of the marls generally show a small amount of potash and phosphoric acid. The percentage of lime in the beds depends largely upon the amount of sand and clay present, forming the matrix of the beds, as the shells are composed almost entirely of calcium carbonate. Some of the marls contain as much as 97 per cent. of calcareous matter. The Virginia calcareous marls are found chiefly in the miocene group of formations and in other places. They are especially well exposed at Yorktown. The cave in which Cornwallis took refuge when he was being cornered at Yorktown by Washington and La Fayette was cut into one of these marl beds. The large areal extent and high lime content of the shell marl beds render them of great commercial value for use in agriculture and in the manufacture of Portland cement.

"The chief use of marl for agricultural purposes is to grind it to a fine powder and apply about forty or fifty bushels to the acre. The effect upon the soil is three-fold. It produces important chemical changes by breaking up many refractory minerals, whose elements reunite to form other compounds which are soluble and serve as plant food; it changes the physical property of soil by making those which are clayey and sticky, porous and permeable to water, and making those which are loose more consolidated, and it is itself used up to a certain extent as a plant food.

Manufacturing Plants.

"One of the principal ways in which the shell marls of Tidewater Virginia are destined to be used is in the manufacture of Portland cement. There is one plant already in operation at Norfolk. This plant, however, is some distance removed from its source of raw materials, which are conveyed to the plant by barges from points near Smithfield, Va., where the querries are located. Charters have been granted to two other companies. One of these plans to build a plant at Yorktown and the other will erect its plant on the James River. The plant at Norfolk is the only plant in the United States manufacturing cement from a mixture of Tidewater marls and clay. This plant, as well as those which will be located in the same section, are said to have a very considerable advantage over their competitors in the matter of cost of quarrying the raw materials. In addition to this, they can be so situated that they will have available both water and rail transportation facilities. Cement is a bulky product and this is obviously an important desideratum. On the whole, therefore, the outlook for the development of a large Portland cement industry in this section is indeed very promising.

"The other materials of the mineral resources of Tidewater Virginia which may be mentioned in this connection are ochres, suitable for mineral paint; iron ore and building stone. The ochres and the iron ore are worked to only a small extent. The deposits of the former are generally more or less impure, but a number are known which could be profitably worked on a small scale. The occurrences of iron ore likewise are found in small quantities and under present conditions in the iron industry, could hardly be worked with profit. Iron ore deposits of this section, however, are of great interest historically, because the first iron ore mined in America was won from the deposits in this section by the Jamestown colonists in 1609. The successful extraction of the metal from this ore led to the erection of the first iron works in the United States, on Falling Creek, in Chesterfield county, about seven miles south of Richmond, from 1619 and 1622."

"The building stones of the coastal plain are of but little importance, both on account of their limited occurrence and inferior quality. In a region where practically all the rocks are unconsolidated, hardened or indurated beds, are pretty certain to be utilized locally for the foundation of buildings and other purposes in which hardened, compact stones are not demanded. Indurated strata occur in almost every formation of the coastal plain of the State, and materials from these beds have been employed for such local purposes."

A HOOKWORM VICTIM.

HOOKWORM UNDER MICROSCOPE.