sandstone in Galicia and Transylvania is rich in salt. The extensive mines at Wieliczka are in this rock-salt, as also is the salt of Kalusz in Galicia, which is associated with sylvite, KCl.

In North America salt is widely distributed at various geological horizons. In New York it occurs in the Salina beds of the Onondaga series, of Silurian age; and Silurian salt is found also in parts of Michigan and in Ontario, Canada. Some of the salt of Michigan is regarded as Carboniferous. Rock-salt is mined in several states, as New York, Kansas and Louisiana; but American salt is mostly obtained from brine. Deposits of salt, regarded as either Cretaceous or Tertiary, occur in the island of Petite Anse, west of Vermilion Bay, in Louisiana. Salt often occurs in association with petroleum and natural gas, and extensive beds were discovered in the Wyoming valley in boring for petroleum. In the dry regions of the West salt occurs as an incrustation on the surface of the soil—a mode of occurrence found in desert areas in various parts of the world.

Cubic pseudomorphs representing rock-salt are sometimes seen in strata which have been deposited in shallow water, especially on the margin of a salt-lake. The salt has been dissolved out of its original matrix, and the cavity so formed has then been filled with fine clayey or other mineral matter, forming a cubic cast. Such casts are not infrequent in the Keuper marls and sandstones, and in the Purbeck beds of England.

*Manufacture.—*The chief centres of manufacture in England are at Northwich, Middlewich, Winsford and Sandbach in Cheshire, Weston-on-Trent in Staffordshire, Stoke Prior and Droitwich in Worcestershire and Middlesbrough in Yorkshire.@@1 The Cheshire and Worcestershire salt deposits are by far the most important. Although brine springs have been known to exist in both these counties ever since the Roman occupation, and salt had been made there from time immemorial, it was not till 1670 that rock-salt about 30 yds. thick was discovered at Marbury near Northwich by some men exploring for coal, at a depth of 34 yds. In 1779 three beds of rock-salt were discovered at Lawton, separated from one another by layers of indurated clay. The old Marston or Marston\* Rock mine is the largest and perhaps the oldest in England. It was worked for about a hundred years in only its upper bed,’but in 1781, after traversing a layer of indurated clay intersected with small veins of salt 10½ yds. thick, a layer of rock-salt 33 to 37 yds. thick was found. Beneath it are others, but they are thin and im- pure. The total depth of the mine to the bottom of the lower level is 120 yds. At Winsford, where the same formation seems to recur, it is 159 yds. from the surface. The Marston mine covers an area of about 40 acres. The salt is first reached at 35-40 yds. in the North­wich district, and the upper layer is 25-50 yds. in thickness (Marston 23-26 yds.) ; it has above it, apparently lying in the recesses of its surface, a layer of saturated brine. This is the brine which is raised at the various pumping stations in Northwich and elsewhere around, and which serves to produce white salt. The beds are reached by sinking through the clays and variegated marls typical of this for- mation. The salt is blasted out with gunpowder. The Middlesbrough deposit was discovered by Bolckow and Vaughan in boring for water in 1862 at a depth of 400 yds., but was not utilized, and was again found by Messrs Bell Brothers at Port Clarence at a depth of 376 yds. In Cheshire the surface-water trickling through the overlying strata dissolves the salt, which is subsequently pumped as brine, but at Middlesbrough the great depth and impermeability of the strata precludes this, so another method has been resorted to. A bore is made into the salt, and lined with tubing, and this tube where it traverses the salt is pierced with holes. Within this is hung loosely a second tube of much smaller dimensions so as to leave an annular space between the two. Through this space the fresh surface water finds its way, and dissolving the salt below rises in the inner tube as brine, but only to such a level that the two columns bear to one another the relation of ten to twelve, this being the inverse\* ratio of the respective weights of saturated brine and fresh water. For the remaining distance the brine is raised by a pump. The fresh water, however, as it descends rises to the surface of the salt, tending rather to dissolve its upper layers and extend superficially so that after a time the superincumbent soil, being without support, falls in. These interior landslips, besides choking the pipes and breaking the communication, often produce sinkings at the surface. The same inconvenience is felt in the environs of Nancy, and a similar one produces on a larger scale the sinking and subsidences at Winsford and Northwich.

In the United States extensive deposits and brine springs are worked, and also incrustations (see above). Canada also is a ρro- ducer. South America possesses several salt deposits and brine springs. Asiatic Russia is very abundantly supplied with salt, as likewise is China; and Persia is perhaps one of the countries most abundantly endowed with this natural and useful product. In India there is the great salt range of the Punjab, as well as the Sambhur Lake, and salt is obtained from sea water at many places along its extensive seaboard.

Rock-salt is the origin of the greater part of the salt manufactured in the world. It occurs in all degrees of purity, from that of mere salty clay to that of the most transparent crystals. In the former case it is often difficult to obtain the brine at a density even approach­ing saturation, and chambers and galleries are sometimes excavated within the saliferous beds to increase the dissolving surface, and water let down fresh is pumped up as brine. Many brine springs also occur in a more or less saturated condition. In cases where the atmospheric conditions are suitable the brine is run into large tanks and concentrated merely by solar heat, or it may be caused to trickle over faggots arranged under large open sheds called “gradua­tion houses ” (*Gradirhäuser),* whereby a more extensive surface of evaporation is obtained and the brine becomes rapidly concentrated. After settling it is evaporated in iron pans. The use, however, of the “ graduation houses ” is dying out, as both their construction and their maintenance are expensive. The purer rock-salt is often simply ground for use, as at Wieliczka and elsewhere, but it is more frequently pumped as brine, produced either by artificial solution as at Middlesbrough and other places, or by natural means, as in Cheshire and Worcestershire. One great drawback to the use of even the purest rock-salt simply ground is its tendency to revert to a hard unwieldy mass, when kept any length of time in sacks. As usually made, white salt from rock-salt may be classified into two groups: (1) boiled; known as fine, table, lump, stoved lump, superfine, basket, butter and cheese salt (Fr. *sel fin-fin, sel à la minute,* &c.); (2) unboiled: common, chemical, fishery, Scotch fishery, extra fishery, double extra fishery and bay salt (Fr. *sel de 12, 24, 48, 60* and *72 heures).* All these names are derived from the size and appearance of the crystals, their uses and the modes of their production. The boiled salts, the crystals of which are small, are formed in a medium constantly agitated by boiling. The fine or stoved table salts are those white masses with which we are all familiar. Basket salt takes its name from the conical baskets from which it is allowed to drain when first it is “ drawn" from the pan. Butter and cheese salts are not stove-dried, but left in their more or less moist condition, as being thus more easily applied to their respective uses. Of the unboiled salts the first two, corresponding to the Fr. *sel de 12 heures* and *sel de 24 heures,* show by their English names the use to which they are applied, and the others merely depend for their quality on the length of time which elapses between successive “drawings," and the temperature of the evaporation. The time varies for the unboiled salts from twelve hours to three or four weeks, the larger crystals being allowed a longer time to form, and the smaller ones being formed more quickly. The temperature varies from 55° to 180° F.

One difference between the manufacture of salt from rock-salt brine as carried on in Britain and on the Continent lies in the use in the latter case of closed or covered pans, except in the making of fine salt, whereas in Britain open ones are employed. With open pans the vapour is free to diffuse itself into the atmosphere, and the evaporation is perhaps more rapid. When covered pans are used, the loss of heat by radiation is less, and the salt made is also cleaner. It has also been proposed to concentrate the brines under diminished pressure. In S. Pick’s system a triple effect is obtained by evaporating in these connected vessels, so that the steam from one heats the second into which it is led (see *Soc. of Eng.,* 1891, p. 115).

In Britain the brine is so pure that, keeping a small stream of it running into the pan to replace the losses by evaporation and the removal of the salt, it is only necessary occasionally (not often) to reject the mother-liquor when at last it becomes too impure with magnesium chloride; but in some works the mother-liquor not only contains more of this impurity but becomes quite brown from organic matter on concentration, and totally unfit for further service after yielding but two or three crops of salt crystals. Sometimes, to get rid of these impurities, the brine is treated in a large tub *(bessoir)* with lime ; on settling it becomes clear and colourless, but the dissolved lime forms a skin on its surface in the pan, retards the evaporation and impedes the crystallization. At times sodium sulphate is added to the brine, producing sodium chloride and magnesium sulphate by double decomposition with the magnesium chloride. A slight degree of acidity seems more favourable to the crystallization of salt than alkalinity; thus it is a practice to add a certain amount of alum, 2 to 12 lb per pan of brine, especially when, as in fishery salt, fine crystals are required. The salt is “ drawn ” from the pan and placed (in the case of boiled salts) in small conical baskets hung round the pan to drain, and thence moulded in square boxes and afterwards stove-dried, or (in case of unboiled salts) “ drawn ” in a heap on to the “ hurdles,” on which it drains, and thence is carried to the store.

In most European countries a tax is laid on salt; and the coarser as well as the finer crystals are therefore often dried so as not to pay duty on more water than can be helped.

The brine used in the salt manufacture in England is very nearly saturated, containing 25 or 26% of sodium chloride, the utmost water can take up being 27%; and it ranges from 38 to 42 oz. of salt per gallon. In some other countries the brine has to be concen- trated before use.

Saltmaking is by no means an unhealthy trade, some slight soreness of the eyes being the only affection sometimes complained of; indeed the atmosphere of steam saturated with salt in which

@@@1The termination “ wich ” in English place-names often points to ancient salt manufacture—the word “wich” (creek, bay; Icel. *υik)* having acquired a special sense in English usage. In Germany the various forms of the non-Teutonic words Hall, Halle occurring in place-names point in the same way to ancient salt-works.