

furnace at Remscheid was still in good condition after four months' continuous working at high temperatures. Calculations based on the same tests showed in actual maintenance costs a saving of more than 50 per cent. in favour of zirconia as compared with the refractory lining ordinarily used. Ferro-zirconium, containing up to 35 per cent. zirconium, obtained by reducing a mixture of the oxides with aluminium, has been prepared and used as the basis of introduction of the metal into steel for armour-plates, armour-piercing projectiles, and bullet-proof steel.

Zirconia also finds application as an addition to melted quartz to prepare "siloxide glass," a product resembling quartz opaque glass, but harder, less fragile, more resistant to mechanical stresses and basic oxides (excepting alkalies), and less easily devitrified than quartz glass.

Recently Ruff and Lauschke have investigated the refractoriness and other properties of zirconia, alone, and mixed with certain other oxides.

HYDRO-GEOLOGY IN THE UNITED STATES.¹

DIPPING into a bundle of recently issued reports of the United States Geological Survey, all exhibiting evidence of the scrupulous care and unwearied industry of those responsible for the collection of data relating to the water-bearing capacities of the several regions under observation, we extract from a considerable mass of information one or two items which seem to possess some general, as well as local, interest.

(1) The topography of certain parts of Arkansas and the adjoining States is characterised by numerous low, circular mounds, from 20 to 100 ft. in diameter, and from 1 to 4 ft. in height. It is stated that in certain districts they are present in astonishing numbers, many fields being completely covered with them. They occur indiscriminately among the unconsolidated clays, loams, marls, sands, and gravels in the lowlands, on the uplands of Cretaceous and Tertiary age, and on the slopes of Palæozoic hills. The materials of which they are composed are in some cases slightly coarser and lighter in colour than the surrounding soils, while in other cases the components are essentially similar in structure, composition, and colour. No satisfactory explanation has yet been put forward to account for these conformations. Springs and gas-vents, coastal dunes and ant-hills, wind action and human agency, have all been suggested as originating or contributory causes; but no single theory fits in convincingly with all the conditions and facts. They remain a standing nuzzle to observers.

(2) The broad desert valleys of New Mexico, composed of gravel, sand, and clay, are designated "bolsons." Rising up at intervals from the level uniformity of their surfaces are narrow, rocky ridges, ranging in length from two to twenty miles, and in height from a few hundred to nearly 2500 ft. It is probable that all these ranges have an underground connection, forming in reality a single range. They represent a thick succession of sedimentary rocks of all ages, from Cambrian to Recent, overlying pre-Cambrian granite, which outcrops in some of the ridges. In places the

¹ (1) "Geology and Ground Waters of North-Eastern Arkansas." By L. W. Stephenson, A. F. Crider, and R. B. Dole.

(2) "Geology and Underground Water of Luna County, New Mexico." By N. H. Darton.

(3) "Ground Water in the Hartford, Stamford, Salisbury, Williamantic, and Saybrook Areas, Connecticut." By H. E. Gregory and A. J. Ellis.

(4) "Ground Water in San Joaquin Valley, California." By W. C. Mendenhall, R. B. Dole, and H. Stables.

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depth of the bolson deposits runs to considerably more than 1000 ft.

(3) The chief water-bearing formations of Connecticut are the unconsolidated materials of Glacial origin which overlie the bedrock. There are two types—the unstratified and the stratified, the former a heterogeneous mixture of débris deposited directly by ice, and the latter the same ingredients, but reassorted and deposited by water. The Glacial drift is only thin, and the surface of the underlying rock rugged. This results largely in the localisation of much of the rainfall (amounting to 45 in. per annum), causing supplies, at times, to be deficient through periods of several weeks, or even months.

(4) One of the difficulties confronting settlers in the San Joaquin Valley, California, is the adverse influence on plant culture of the alkali salts in the soil. If the alkali content be in any degree excessive, growth is retarded, and possibly arrested altogether. The farmer has to control the accumulation of soluble salts near the surface of his land, if he is to obtain satisfactory results. A common practice is to flood the area with water, which dissolves the alkali salts and carries them down below the zone of influence on delicate rootlets; but this method is only partially effective, unless measures are taken to prevent surface evaporation by means of the shade afforded by trees and the cover of stands of grass or grain. B. C.

SCIENCE AND INDUSTRY.

THE important and impressive review of the rise and progress of the organic chemical industry issued by Messrs. Levinstein, Ltd., of Blackley, near Manchester, and of Ellesmere Port, which appeared as a supplement to the *Manchester Guardian* of June 30, marks a welcome development of industrial enterprise. Even the most indifferent and ill-informed reader cannot but be made aware, as a result of its perusal, of the importance of the highest facilities for scientific education and training, when in so striking a fashion he is compelled to realise the fruits of it in the enormous industrial advance of Germany in all that pertains to the organic chemical industries, whether it takes the form of artificial dyestuffs, synthetic organic products, or that of chemico-therapeutics. The advent of the war quickly laid bare our serious deficiencies, not to say our utter poverty, in all three departments of chemical manufacture.

In the course of the articles, which have been written by men eminent in their respective fields of chemical science and its applications, the distinction is made absolutely clear as between industries the development of which has mainly been the result of the adoption of steam power and of mechanical appliances, and those depending upon fundamental researches of a physical and chemical character, such as are, to use the phrase of one of the writers, "built up from the depths," and require, therefore, not merely the energetic business organiser and "scientific management," with a view to output, but the highly trained scientific man capable of appreciating the discoveries of pure science and apt in their application to human needs. In this valuable review of the progress of the many departments of a vital industry—the key, indeed, to the successful prosecution of many allied and dependent industries—it is clearly revealed how remiss the nation has been in a true appreciation of what constitutes the firm foundation of industrial pre-eminence. The fault has lain not so much, as some of the writers seem to indicate, with the colleges and universities as with the industries concerned, which have hitherto offered small salaries and poor prospects to the carefully trained and competent science student; indeed, have looked upon