tried to win their allegiance by the grant of various privileges. But, when they attempted to bring them under the centralized rale of the empire and prosecuted them for nonconformity, the Cossacks revolted, first under Razin, and afterwards under Puga­tcheff. After the latter rising, the name of Ural was officially given to the Yaik river and the Yaik Cossacks. The disbanding of their artillery, the planting of Russian garrisons within the domains of the *voisko,* and the interference of Russian officials in their interior organization during the 19th century occasioned a series of smaller outbreaks, the latest of which, in 1874, against the new law of military service, resulted in the deportation of 2500 Cossacks, with their families, to Turkestan.

URALSK, capital of the above province, is situated on the upper Ural, at its confluence with the Tchagan, 1095 miles south-east from Moscow. The town is well built, with regular streets; among its prominent buildings are the theatre, the club, and two gymnasiums; and it is beautified by numerous gardens. The scientific society issues publica­tions of great value. There is a very brisk trade in fish, cattle, hides, tallow, grain (exported), and in manufactured goods (imported). The population in 1879 was 20,680.

URANIUM, the name of a rather rare metallic element, already briefly referred to under Chemistry (vol. v. p. 542). The credit of its discovery as an element must be assigned to Klaproth, who in 1789 isolated from pitch-blende a yellow oxide which, while obviously metallic, was foreign to all the known metals. He accordingly viewed it as the oxide of a new metal, which he named uranium, after the newly discovered planet of Herschel. From the yellow oxide he obtained, by reduction with charcoal at a high temperature, what he took to be metallic uranium. Ber­zelius about 1823 found that the yellow oxide, when treated with excess of sulphuric acid, united with it into a sulphate, not unlike the ferric salt Fe2O3.3SO3 in its character. Hence he concluded that the uranium salt is Ur2O3.3SO3, where Ur2O3, according to his analysis, re­presents 864 parts of yellow oxide, if Fe2O3=160 or O = 16. Like Fe2O3, the yellow oxide lost 48 parts of oxygen per Ur2O3 = 864 parts as water, while Ur2 = 816 parts of metal remained.@@1 These results were universally adopted until Péligot in 1840 discovered that Berzelius’s (and Klaproth’s) metal contains oxygen, and that his (Ur2) O3 really is (U6O6). O3 = 3U2O3, where U = 120 is one atomic weight of real uranium. Péligot’s results, though called in question by Berzelius, have been amply confirmed by all subsequent investigators; only now, on theoretical grounds, first set forth by Mendeljeff, we have come to double Péligot’s atomic weight, so that through­out this article U signifies 240 parts of uranium, while UO3 stands as the formula of the yellow oxide, and UO2 as that of Berzelius’s metal.

The only practically available raw material for the extraction of uranium is pitch-blende (Germ. and Fr. *Uranpecherz),* which occurs associated with lead and silver ores, chiefly in Joachimsthal and at Przibram in Bohemia, at Schneeberg in Saxony, and at Redruth in Cornwall, forming greenish or brownish black masses clustering together like grapes. Its hardness is 5∙5. The specific gravity varies from 6∙4 to 8, the mineral almost invariably presenting itself in intimate intermixture with a host of foreign metallic compounds, such as sulphides, arsenides, &c. Pure pitch-blende is U3O8, which in relatively good specimens forms some 80 per cent. or more of the whole.

In the chemical treatment of the ore, it is expedient to begin by removing at least part of the arsenic and sulphur of the admixtures by roasting, and then to wash away the light oxides with water or dissolve them away with hydrochloric acid. In one of the many processes proposed the purified ore is disintegrated with hot nitric acid, to produce nitrates, which are then converted into sulphates by evaporation with oil of vitriol. The sulphates are treated with water, which dissolves the uranium and other soluble salts, while silica, sulphate of lead, &c., remain ; these are removed by filtration. From the solution the arsenic, copper, &c., are precipitated by sulphuretted hydrogen as sulphides, which are filtered off. The filtrate contains the uranium as uranous and the iron as ferrous salt. These are oxidized by means of chlorine or some other oxidizing

agent, and precipitated conjointly by excess of ammonia. The pre­cipitate, after having been collected and washed, is digested with a warm concentrated solution of carbonate of ammonia, which dissolves the uranium as a yellow solution of uranate of ammonia, while the hydrated oxide of iron, the alumina, &c., remain. These are filtered off hot, and the filtrate is allowed to cool, when crystals of the uranate separate out. The mother liquor includes generally more or less of nickel, cobalt, zinc, and other heavy metals, which, as Wohler showed, can be removed as insoluble sulphides by the addition of sulphide of ammonium ; uranium, under the circum­stances, is not precipitated by sulphide of ammonium. The filtrate, on being boiled down, yields a second crop of uranate of ammonia. This uranate when ignited in a platinum crucible leaves a green oxide of the composition U3O8, *i.e*., artificial pitch-blende, which serves as a starting point for the preparation of uranium compounds. The green oxide, as a rale, requires to be further purified. One method for this purpose is to convert it into a solution of the nitrate UO2(NO3)2, and from it to precipitate the metal as oxalate by the addition of oxalic acid (Péligot). The latter (UO2.C2O4) yields a purer oxide, UO2, or, in the presence of air, U3O8, on ignition.

Metallic uranium, as shown by Péligot, can be obtained by the reduction of a mixture of dry chloride of potassium and dry uranous chloride, UC14, with sodium at a red heat (for details see handbooks of chemistry). The metal, which is easily separated from the slag by treatment with water, remains as a dark heavy powder or in white compact globules, according to the temperature at which it was produced. According to Zimmermann, to whom we owe a recent investigation on the matter, pure compact uranium is a white malleable metal, which is pretty hard, though “ softer than steel.” Its specific gravity has the high value 18∙7 ; its specific heat is 0∙02765, corresponding to U = 240. The fusing point, from Zimmermann’s statements on its preparation, seems to lie at bright redness. The compact metal when exposed to the air tarnishes only very slowly. The powdery metal when heated in air to 150o or 170° C. catches fire and burns brilliantly into U3O8. Dilute sulphuric acid attacks it but slowly ; hydrochloric acid, especially if strong, dissolves it readily, with the formation, more immediately, of a hyacinth-coloured solution of U2Cl6, which, however, readily absorbs oxygen from the air, with the formation of a green solution of UC14, which in its turn gradually passes into one of yellow uranyl salt, UO2.C12.

*Uranous Compounds.—*The oxide UO2 (Berzelius’s metal) is pre­pared by heating the green oxide U3O8 in hydrogen. It dissolves in hot oil of vitriol ; the mass, when treated with water, dissolves ; from the solution green crystals, U(SO4)2 + 8H2O, are obtainable. The anhydrous chloride UC14 was prepared for the first time by Péligot by heating an intimate mixture of the green oxide and charcoal to redness in a current of dry chlorine ; it is obtained as sublimate of black-green metallic-looking octahedra. The chloride is very hygroscopic. Uranous salts pass into uranic (uranyl) com­pounds under the same circumstances under which ferrous salts become ferric, only they do so far more readily.

*Uranic Compounds.—*By keeping the nitrate UO2(NO3)2 at a temperature of 250° for a sufficient time the oxide UO3 is obtained as a chamois-yellow solid, insoluble in water, but soluble in acids, with the formation of uranyl salts, UO2.C12, &c. The oxide, in other words, behaves to acids as if it were the monoxide of a radical (UO2) uranyl. The sulphate (UO2)SO4 + 3 or 3∙5H2O is de­posited from a syrupy solution in yellow crystals. The nitrate (UO2)(NO3)2+6H2O forms large yellow crystals easily soluble in water. This salt is used in photography, also in analysis as a characteristic precipitant for phosphoric acid. If a solution of a uranyl salt is mixed with one of ammonia, or potash, or soda, the uranium is precipitated in the form of a uranate, U2O6R2O, of the respective alkali. Uranate of soda, forming yellow crystals of the composition Na2U2O7 + 6H2O, is made industrially, being used for the production of yellow uranium glass in porcelain painting. The Joachimsthal works in 1875 produced 70 cwts. of this “oxide," representing a value of £8500.

*Analysis.—*A borax bead dissolves uranium oxides in the re­ducing flame with a green, in the oxidizing flame with a yellow, colour. Solutions of uranyl salts (nitrate, &c.) behave to reagents as follows: sulphuretted hydrogen produces green uranous salt with precipitation of sulphur ; sulphide of ammonium in neutral solutions gives a black precipitate of UO2S, which settles slowly and, while being washed in the filter, breaks up partially into hydrated UO2 and sulphur ; ammonia gives a yellow precipitate of uranate of ammonia, characteristically soluble in hot carbonate of ammonia solution ; prussiate of potash gives a brown precipitate which in appearance is not unlike the precipitate produced by the same reagent in cupric salts. (W. D.)

URANUS *(i.e.,* Heaven) is in Greek mythology the husband of Gæa (Earth) and father of Cronus (Saturn) and other deities. See Mythology, vol. xvii. p. 155, and Saturn.

@@@1 We substitute for Berzelius’s actual numbers the corresponding values calculated from our present constants.