pieces; soiling; adhering but little to the tongue; not remarkably heavy, but almost light. This scaly lithomarge, which, on account of its very greasy feel, we might be induced to call "earthy talc" (which, however, cannot be recognised by us till the presence of magnesia in it is proved), is certainly nothing more than a modification of mica, which, in its usual state, appears hard and foliated, but here very soft and scaly. Small pieces of crystallised quartz, rock-crystals, and topazes are found embedded in it.

2. This soft mass further consists of little round pieces of a snow-white friable lithomarge, which is faintly glimmering between fine scaly and pulverulent soils, adheres to the tongue, is fine and greasy to the touch, and light. In it there is ironglance, crystallised in small six-sided tables, and topazes in still greater proportion.

3. This lithomarge in the form of small blunt-edged pieces often adopts a yellowish, then a light, and, at last, a very dark brown colour, being entirely impregnated with iron-ochre. There are in it still more little six-sided tables of ironglance than in the white lithomarge.

It is remarkable that the topaz, the euklase, and the quartz crystals in this formation are always found detached, and very often in fragments; but it would be a great mistake to infer from this, that the abovementioned fossils are in a secondary repository. If we compare the occurrence of the softened mass of mica (or lithomarge) at Capâo and Lana, with the more solid, though still pretty soft, varieties of mica, at Jozé Correa and Chapada, to the south of the former places, and of the Morro, near Villa Rica, we must be convinced, that both are quite similar in their origin and age, and have only undergone a modification with respect to their greater or less solidity. As we believe that every considerable repository of porcelain earth, on and in gneiss and granite, is an original formation, so we are convinced that this repository of mica (if we may use this expression)

must be considered as such a one, and, consequently, not essentially differing from the usual formation of the mica-slate.

Notwithstanding all that has been said, for some years past, respecting the occurrence of topazes in Brazil, there always has remained, on nearer examination, great uncertainty and doubt. Mr. Von Eschwege, in Baron Von Moll's Annals, vol. iii. No. 3., says — "Chlorite-slates are generally the lower ranges of the higher sandstone mountains, and in them they dig for topazes in the country round Villa Rica; topazes are found in them only irregularly, here and there in nests and kidneys of lithomarge, fine white sand, rock-crystal, all which lie loose and promiscuously aggregated, partly crystallised, partly in irregular sharp-edged pieces; sometimes the topazes are imbedded in rock-crystal ..... The manner in which the topazes are obtained is with broad hoes, as the chlorite-slate is quite decomposed and forms fullers'-earth, &c." In the Journal of Brazil, the same gentleman remarks: — "The Morro Deos te Livre consists of sand-stone and chlorite-slate. ..... From this place to Capâo de Cane, the principal species of rock is clay-slate, here and there forming a passage into chlorite-slate. This latter forms smaller mountains, often much decomposed and ferruginous, passes into fullers'-earth, and is then the matrix of the yellow topazes, which are frequently found in it in nests, with lithomarge. The chief mine is at Capâo. All the topazes found there have the peculiarity that they are broken; not a single crystal is found growing to another rock; even the rock-crystal, which occurs with them, is also broken; sometimes it is seen growing together with a topaz. The topazes, as well as the rock-crystal, show, in the fracture, a great freshness, as if they were but just broken, and lie in nests confusedly mixed together, surrounded with lithomarge. It is extremely difficult to form a hypothesis in what manner they came into the regularly stratified

chlorite-slate. In order to make a still greater confusion of ideas, we have only to put the questions—Where was the matrix from which they were separated? What power could that be which so broke to pieces the matrix and themselves, that not one stone remained connected with another, but each appears wholly insulated? If they were rent from another place and here brought together again, how comes it that lithomarge, as it were, prepared a bed for them in which they were deposited, as in their original situation?" In Gilbert's Annalen der Physik, vol. i. p. 4., M. Von Eschwege again says, that in the chlorite-slate, topazes are enveloped in lithomarge; nay, in his latest geognostic description of Brazil, where he himself says, that he has formerly written various things on these subjects with which he is not now quite satisfied, he still observes:—"That talc and chlorite-slate appear inseparable; where the rock is entirely decomposed into fullers'-earth they find, in nests or groups, enveloped in lithomarge, the beautiful yellow topazes, and also the rare euklase; and often, in large fine six-sided tables of crystallised ironglance, with crystallised talc, rock-crystals with topazes immersed in them, or topaz-crystals with rock-crystals immersed, also cyanite, &c."

John Mawe, in his Travels in Brazil, has described the occurrence of topazes very differently, and, in our opinion, more correctly. According to his observations, the topazes are found at Capâo in narrow veins in a clay-slate passing into mica-slate. He thought that they were no longer in their original repository; that the crystal had but one acumination, and consisted of fragments; some were, indeed, grown together with quartz, but even the quartz itself appeared but in fragments. The topazes were enveloped in friable earthy talc and large crystals of ironglance, &c.

If our observations on the occurrence of the topazes are compared with the preceding remarks, it appears that they are found neither in chlorite-slate nor in a fuller's-

earth, produced by the decomposition of this chlorite-slate, or fine white sand, but in a greasy mica, modified into lithomarge, which may be called scaly lithomarge, and in friable lithomarge, partly pure and partly mixed with much red ochre, which is accompanied with quartz and porcelain earth. Mawe has comprehended both the varieties, under the name of soft earthy talc, for which they certainly may be taken.

Mr. Von Eschwege himself has adduced the most solid reasons against the assertion of a secondary repository. On such a supposition we must assume a flötz chlorite-slate, and even regularly stratified; besides, we do not find the matrix from which the topazes may have been detached; neither is it to be conceived how, under such circumstances, they could be enveloped in the lithomarge, as in an original repository. We may add, that this is the more difficult to be explained, when we consider that both on the topazes and euklase evident impressions of very fine scales of lithomarge are to be seen, which may seem sufficiently to prove the simultaneous formation.

Lastly, if we must absolutely explain the origin of so many fragments of topazes, euklase, and quartz, the hypothesis of Mr. Zinken appears to be the most probable, according to which, these minerals have been formed in their original repository, but that a subsequent inundation penetrating into the friable mass of mica, loosened it, and hereupon the little cavities which arose at the formation of the separate crystals, collapsed, and fractured the crystals of topaz and euklase, which always have innumerable rents and fissures. Besides the occurrence of the topazes in the scaly and crumbly lithomarge, which evidently owes its origin to mica, has a great analogy with the origin of the emerald in mica, or mica-slate, in the valley of Heubach, in the principality of Saltzburgh.

Mr. Frischholtz says, in Baron Von Moll's new Annals, vol. iv. No. 3., " That mica, separates from the gneiss,

and forms veins several feet thick. Emeralds are seldom found in gneiss, but always in mica: when this latter is soft, and almost unctuous to the touch, the emeralds contained in it are larger, of a more beautiful green, perfectly formed, and the lateral planes clear of the matrix. They are never found massive, but the crystals disseminated, and confusedly aggregated in the mica, very rarely embedded in quartz; in the latter case they are greenish white, or even white, as the quartz itself."

These emerald crystals too are full of impressions of the surrounding mica, like the topaz and the euklase; so that the original repository of the latter appears to be the less liable to any farther doubt.

If, in addition to this origin of the emerald, we farther consider that the pycnite, which is the nearest allied to the topaz in its component parts, likewise occurs in mica; if we attend to the occurrence of the topazes in the topaz rock and lithomarge at Auerbach, in Saxony, we shall find their repository and that of the euklase in Brazil, which is akin to the emerald, little or not at all varying from that known in Germany, and thus have another proof that in this respect also the inorganic new world is conformable to the old. Even the modified mica, the scaly lithomarge, or Mr. Mawe's earthy talc, is met with in Bavaria, namely, in the country from Waltershoff to Pullenreuth, for an extent of two leagues, so nearly resembling that from the district of Capâo, that it is often very difficult to distinguish them. Only the mode of occurring is different; while, if the latter is to be regarded as a considerable bed, the former, according to Mr. Von Flurl's Description of Mountains, p. 424. sometimes forms a flötz stratum of great extent, and three fathoms thick, in which lies a compact and fibrous brown iron-stone, and in conjunction with this even a kind of talc-like, or micaceous iron-stone, which is rather allied to mica. Several flötz deposits of this modified mica, or earthy talc, are described by Dr. Reuss, in his Orographie des

Böhmischen Mittelgebirges, p. 122. and 146., in which the red garnets are found embedded.

We have already mentioned the principal colours of the topazes found in Brazil. Those in our possession, which are for the most part crystallised, are, 1st. four-sided prisms, with cylindrical, convex, lateral planes; and, 2dly. eight-sided prisms, in which the lateral planes, meeting in a very obtuse angle, may be clearly observed. In the first case the prisms are acuminated by four planes, set on the lateral planes; in the latter, the solid angles of the nearly rectangular lateral edges are more or less truncated, so that the acumination appears of six planes. The lateral planes of the crystals are longitudinally striated, though, in some of them this striation is hardly perceptible. The terminating planes are rough, but some of them are so evidently notched on the acuminating edges, which may be considered as a continuation of the nearly rectangular lateral edges, that it is impossible not to perceive the origin of the crystal out of many small ones, each of which had a tendency to form its own distinct acumination. In this aggregation of several small crystals into one, we must probably seek the cause of the striated lateral planes, and the rough terminating planes. The remaining marks are common to them all, only in some dark yellow pieces, small scales of ironglance, perhaps little six-sided tables, are embedded, and seem thereby to allow the inference that the topazes have a deeper colour in proportion as the surrounding lithomarge is more ferruginous.

The euklase, which, in common with the emerald, occurs in the modified mica, or scaly lithomarge (which contains no magnesia, like chlorite and talc), is in the specimens of a light mountain-green colour. The rarity of a complete crystal will long be a hindrance to an accurate description of it. The best defined crystal before us is a four-sided oblique prism (according to the measurement of Mr. Fuchs, in Landshut,) of 115° and 65°, broken at one end,

and bevilled at the other, by planes obliquely set on the acute lateral edges, so that the edges of bevilment form with the obtuse lateral edge an angle of 133°, and the bevilled planes meet under one of 106°. At the upper corner of the bevilment, there are four other small planes, which make a kind of acumination; two of these planes are smooth, the two others clearly notched, and show, as in the topazes, that the crystal is composed of several small ones. The lateral planes are longitudinally striated, and curved towards the obtuse lateral edge, so that the crystal has a reed-shaped appearance. The striation of the lateral planes most probably arose from the accumulation of the abovementioned smaller crystals, which formed several little planes, that are divided by furrows, whence the angles of the lateral edges can only be measured at the sharp edge.

In the pieces of euklase in our possession, we observed only one cleavage, namely, in the direction of the short diagonal of the terminal planes, or across the acute lateral edges, and which is in the highest degree perfect. The transverse fracture appears conchoidal. Some lateral and terminal planes of the crystals are rough, with numerous small impressions caused by the scales of the lithomarge, as in the emerald and topaz, and thus leave no room to doubt that this latter is their matrix.

We have observed above, that with the topazes and euklases, there occur also quartz and rock-crystals of different sizes; we will here particularise only two of the former and two of the latter, which are deposited in the Brazilian museum at Munich.

A piece of greyish white transparent quartz, has no regular shape, but the whole surface is full of impressions, which are frequently deep, occasioned by topaz crystals. Two fragments of the latter, of a light and dark yellow colour, still grow together with it.

The second piece of quartz is a six-sided prism, acuminated at both ends with six planes, crystallised, large, pellucid,

semitransparent, and with many impressions, some of them very deep, one of which, measured diagonally, is nearly an inch broad; it may be asserted with the more confidence that they proceed from topaz crystals, as small fragments of such are still adhering to some of them. The surface of this quartz crystal is rough, probably from the impressions of the scaly lithomarge. Four crystals of rutile, of middling size, are grown together with it.

One rock-crystal is greyish white, at one end acuminated with six planes, at the other, having many impressions, which have been the more certainly caused by silvery mother of pearl colour mica scales, as such are grown together with it, not superficially only, but in the mass stellarly aggregated. The other remarkable piece of rock-crystal is a large fragment, with two opposite broad lateral planes. The surface is partly smooth, partly with many impressions, the origin of which is shown by some small tables of ironglance growing together with it. On this crystal, three small topazes grow superficially, and several small ironglance crystals in the interior.

For the above remarks on the topaz formation, as well as for the subsequent ones, on the several formations about Villa Rica, we are obliged to Chevalier V. Wagner, director of mines, who has had the goodness to determine all the minerals collected by us in Brazil, and to communicate to us the geognostical decisions resulting from the examination of them, and comparisons with the mode of occurring in Germany.

TRAVELS IN BRAZIL.

BOOK IV.

CHAPTER I.

STAY IN THE CITY OF VILLA RICA.

Villa Rica, the capital of the province of Minas Geraës, the residence of the governor-general and of the ouvidor of the Comarca Oiro Preto, is built on two hills of the eastern declivity of the mountain of the same name, on the Oiro Preto, subsequently called Do Carmo, which is the boundary between the lofty Itacolumi and the Morro de Villa Rica. The streets leading from that part of the city situated in the valley Do Oiro Preto, to that lying upon the hills, are all paved, provided with fourteen wells, and connected by four stone bridges; among which, the new one in the valley, erected by Mr. Von Eschwege, is the

handsomest; the principal street runs half a league along the slope of the Morro. The houses are built of stone, two stories high, covered with tiles, the greater part are white-washed, and, though not very striking in their external appearance, are convenient, and adapted to the elevated situation of the town. The most remarkable of the public buildings are ten chapels, two considerable parish churches, the exchequer, the theatre, where plays are acted by an itinerant company, the Latin school, the town-house, with the prison, most of the inmates of which are murderers, whose crimes have originated in robbery or intrigue; but above all, the castle, the residence of the governor, which is defended by some cannon, and situated on the highest projection of the hill, commands part of the city and the market-place, and enjoys a fine prospect over the whole country.

This place, though hidden in a narrow defile and surrounded by mountains and unfruitful stony campos, was always a favourite spot, to which not only Paulistas, but even Portuguese, frequently resorted in great numbers. The population of all Minas is now stated at half a million, and that of the city at 8500 souls. In the latter, the number of Portuguese from Europe, is proportionably great. The men capable of bearing arms are divided into two regiments of auxiliary cavalry (militia), fourteen companies of local

militia of whites, seven of mulattoes, and four of free negroes.* Almost all kinds of trades are carried on here, the principal of which are the saddlers, tinmen, and blacksmiths; there are likewise manufactories of gunpowder, beaver hats, and pottery. No other town in the interior of Brazil has such a brisk trade as Villa Rica. There are roads from this place by way of S. Joâo d'El Rey to S. Paulo; by Minas Novas to Bahia; by S. Româo, Tejuco, Malhada, to Paracutú, Goyaz, and Matto-grosso; but none of these is so much frequented by caravans passing backwards and forwards, as that leading to Rio de Janeiro, which is seventy miles distant. Almost every week large convoys set out with the productions of the country, cotton, hides, marmalade, cheese, precious stones, gold bars, &c., and bring in exchange from the capital, salt, wine, calicoes, handkerchiefs, hams, looking-glasses, iron-ware, and new negroes to be employed in the gold-washing, &c. The trade with the more remote districts of the interior, is not, indeed, so great as that of S. Paulo and Rio, which is carried on even as far as Goyaz and Matto-grosso, yet it extends even beyond the Rio de S. Francisco, almost over the whole capitania, and supplies it not only with the European articles purchased at Rio de Janeiro, but also with the produce of the environs; for in-

* See Note 1. page 198.

stance, iron goods, beaver hats, pottery, cheese, maize, beans, marmalade, pork, and bacon, which is used instead of butter and lard, and is a staple article in the trade of the province.

The climate of this capitania on account of its elevated situation, is very temperate, and favourable to European fruits. During our residence in Villa Rica, the thermometer varied very much; in the morning before sunrise it was at 12° R., at noon at 23°, in the evening at 16°, and at midnight at 14°, The barometer rose and fell between 23 and 25.50; the whalebone hygrometer varied from 55° to 70°.* The weather was very pleasant, but often cooled by sudden thunderstorms. During the cold months, June and July, the plantations are sometimes injured by night frosts; thus, in the year before our arrival, a considerable part of the crop of banians, sugar-cane, and coffee was frozen. The winds blow from various directions, and are never accompanied by great heat, but frequently thick fogs, which often envelope the summits of the neighbouring mountains. The heat is accordingly less through

* Mr. Von Eschwege (V. Moll's new Annals of Mining, vol. iii. No. 3. p. 338.) observes, that Fahrenheit's thermometer in the heat of summer, never rose above 82° in the shade at noon, and in the winter, never fell below 54°. His barometer fluctuated between 26.564 and 26.090 (English). He observed at Rio de Janeiro, a magnetic inclination of 28° 44′ 30″ S., and 21 vertical oscillations in a minute; at Villa Rica, he found the inclination to be 29° 31′, the oscillations in a minute 20.8.

the whole year, and the air more salutary than in the other provinces. The prevailing diseases are mostly catarrh and rheumatism; inflammations of the throat and lungs, violent cholic, and acute rheumatism are the most frequent. The negroes are observed to be particularly subject to elephantiasis and a peculiar kind of leprosy (*Mal de S. Lazaro*) of which we shall have occasion to speak in the course of our narrative.

Agriculture is not carried on to any considerable extent in the greater part of this mountainous capitania for want of woods, and because the stony soil in the unfruitful campos is entirely exposed to the heat of the sun; but, on the other hand, the province possesses other treasures. Almost every kind of metal is found here: ironstone, which produces ninety per cent., is met with almost everywhere, and it constitutes, in a manner, the chief component part of long chains; lead is found beyond the Rio de S. Francisco in Abaité; copper in S. Domingos, near Fanado in Minas Novas; chrome and manganese in Paraöpeba; platina, near Gaspar Soares and in other rivers; quicksilver, arsenic, bismuth, antimony, and red-lead ore, about Villa Rica; diamonds, in Tejuco and Abaité; yellow, blue, and white topazes, grass and bluish green aqua-marines, red and green tourmalines, chrysoberyls, garnets, and amethysts, principally in Minas Novas. But what has chiefly contributed to the great influx of

settlers, and to the rapid population of this capitania, particularly of the capital, is the great abundance of gold which has been obtained for above a century.*

The gold is found in the country about Villa Rica in the form of powder and fine dust, or in larger or smaller folia, in crystals, particularly in octahedrons and tetrahedrons, in dendritical form, lastly, though more rarely, in whole lumps. There is an instance of a massy piece which weighed sixteen pounds; in colour, it is yellow, black, or whitish, according to the different proportions of the chemical and mechanical admixture of platina, iron, and other metals. Hitherto it has been washed out of streams and rivers, from the clayey surface of the soil, or out of stamped auriferous quartz veins, or iron-stone flötz. It is related that this metal has even been found in heaps, under the roots of plants pulled out of the ground, whither it had been accidentally washed by the rains. We first of all saw here the gold-washing in the Ribeirâo de Oiro Preto, in which, as the rivers are not private property, some negroes were almost constantly employed. No free men, except blacks, follow this occupation, and they only when they happen to want money to supply their wants, and particularly brandy. The gold-washers (*faiscadores*) are dressed in a leathern jacket, with a round bowl

* See Note 2. page 199.

cut out of the wood of the fig-tree (*gamelleira*), from a foot and a half to two feet in diameter, and a foot deep, (*gamella*, *panella*, *patea*,) and a leather bag fixed before them. They generally select those places in which the river is not rapid, where it makes a bend, and has deep holes. They first remove the large stones, and upper layers of sand, with their feet or their gamella, and then take up a bowl full from the deeper and older gravel of the river (*cascalho virgem*). They continue to shake, wash, and strike off the stones and sand at the top, till the heavy gold dust appears pure at the bottom of the vessel, on which a little water is thrown in with the hand, and the gold at length put into the leathern bag. This mode of gold-washing is here called *mergulhar*, diving. Every bowl of cascalho, the washing of which requires about a quarter of an hour, generally yields from one to two vintems*, and a man may gain in this manner, several florins in a day. They sometimes wash the cascalho upon a platform (*canoa*), erected on the spot.

Having now reached the celebrated centre of the gold country, we ardently wished soon to visit the mines themselves. Our friend, Mr. Von Eschwege, kindly met our wishes, and conducted us to the eastern declivity of the Morro de Villa Rica, which has hitherto yielded the greatest abundance. From the southern hill of the moun-

* A Vintem is $1\frac{1}{20}$d.