most conspicuous instance of the dependence of industrial activity upon economic geological conditions.

It is a common-place to comment on all the political consequences of this shifting of the greatest of modern industries; where a half a century ago the region east of the Appalachians and north of the Potomac controlled our national policy, to-day it is that group of communities in the upper Mississippi valley whose purposes control the policy of the Union.

The serious problem from the economic side is expressed by the fear of an early exhaustion of our stores of iron ore. Here we have the frank recognition of our dependence upon the economic geologist. What other stores of metals may be found and how they will affect the situation are questions of the future, but when we look abroad we see in the struggle between Russia and Japan an effort to control, what upon good geological authority, are said to be the richest coal and iron deposits in existence. The possession of those great stores by people familiar with modern metallurgical processes and abundant labor and a sufficient transportation system carrying with it proper economic aptitudes, will cause a collision of economic systems such as has been paralleled only in the great struggles between Great Britain and France in the eighteenth century and in the earlier struggles for the control of the Mediterranean basin.

It will be the part of wisdom, in order that those who are to control our industrial and political policy of the future may understand the problem, to make such a coordination in our scientific work of those studies which elucidate each other. To realize the historical consequences of the smelting of the metals, to make mineralogy and geography elucidate history, will give to our efforts a substance of organization that cannot but prove fruitful.

THE TERLINGUA QUICKSILVER DEPOSITS.

H. W. Turner.

The Terlingua mining district is situated in Brewster County, Texas, in sight of the Rio Grande and about 80 miles in an air line southeast of Marfa, a station on the Southern Pacific railroad. The district and its deposits of mercury minerals have already been described in a number of publications noted under Bibliography at the end of this article. The most complete of these publications is Bulletin No. 4 of the Texas State Mineral Survey, Dr. W. B. Phillips, director.[1] This paper may be considered as supplemental to that bulletin.

The known deposits of quicksilver ores of commercial value are embraced in the east to west zone 15 miles in length, with a width of about two miles. Cinnabar has also been found in Christmas Mountain, northeast of Big Bend and south of the Chisos Mountains, near the Rio Grande. At the latter locality some very good ore has been found. According to the geological map of the region published by the State Survey, both of these deposits are in Lower Cretaceous limestone. It also occurs in Mexico to the west of Terlingua in a lode associated with galena. This lode has not yet been exploited.

THE GENERAL GEOLOGY OF THE DISTRICT.

The formations represented in the quicksilver zone comprise:

1. Tertiary lavas.
2. Upper Cretaceous sandstones and shales.
3. Lower Cretaceous sediments, chiefly limestone, comprising in descending order—Vola limestone about 50 feet thick, Del Rio shale about 100 feet thick, Fort Worth limestone about 100 feet thick, Edwards limestone perhaps 1,000 feet thick.[2]

[1] A paper also appeared in this journal, Vol. I., No. 2, pp. 155–162, by W. B. Phillips.

[2] The magnificent fault scarp at the mouth of the Grand Canyon of the Rio Grande, where it is joined by Terlingua Creek, exposes 1500 feet of

The relation of these formations to one another and the outcrops of the various lodes are shown on the sketch map, Fig. 16.

DEPOSITS IN TERTIARY LAVAS.

The Big Bend District.—To the east of Terlingua Creek and forming the eastern portion of the zone here described, are a series of volcanic hills rising from a basement of Upper Cretaceous shales and sandstones. The topography is in marked contrast with that of the middle and western portion of the quick-

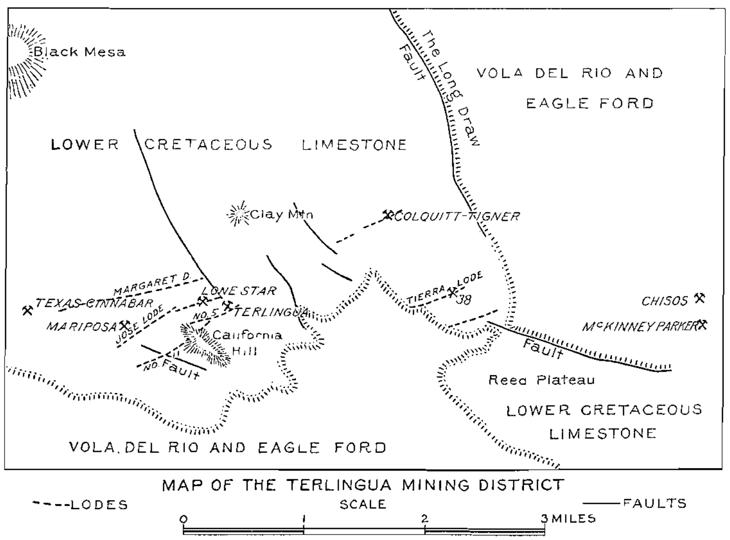


FIG. 16.

silver belt, where limestone mesas predominate. This eastern section is known locally as the Big Bend district, from the post-office of that name. The mines here were only superficially examined.

While cinnabar deposits are found in the sedimentary rocks of this area, they occur chiefly in the volcanic rocks. Study Butte is a flat-topped hill rising 235 feet above the surrounding flat-

nearly horizontal massive limestone, the greater portion of which is presumably the Edwards limestone, but at the mines the thickness of this formation is not yet known. The determination of the above formations is by Robert T. Hill and the Texas Mineral Survey.

lying Cretaceous sediments and having an altitude above sea level of 2,835 feet. The butte is capped by a sheet of rather coarse-grained, light-gray lava, shown by the microscope to be a trachyte, overlying Upper Cretaceous shales, this relation being finely seen on the steep south slope. On the north slope of the butte this lava sheet is flexed downward, dipping under the detritus of the valley. On this north slope the still nearly horizontal shales are seen to *overlie* the lava, showing that the sheet is intrusive and that it here cuts across the bedding planes of the shales. The cinnabar deposits occur chiefly in this lava on the north and east slopes of the butte and at its northeast base. They are being exploited by two companies, the Big Bend Cinnabar Mining Co. and T. P. Barry and associates, the two properties being adjacent to one another.

The ore, so far as known, is entirely in the form of cinnabar, but contains likewise a large amount of iron di-sulphide, presumably pyrite. The lava is much intersected by joint planes and to some extent by seams along which movement has taken place. These joint planes and seams are to a greater or less extent filled with cinnabar, accompanied by some calcite. No quartz or other form of silica was noted. The cinnabar likewise impregnates the whole mass to a slight extent. In the Dallas shaft, at the northeast base of the hill, what appears to be a fissure vein was encountered containing some very good ore, and I understand that the same vein extends westerly into the Big Bend property. On the latter property, on the north slope of the butte, the Upper Cretaceous shales overlying the lava sheet contain at least one rather persistent seam of high grade ore and the values are said to extend into the shale for a foot or more on either side of this seam.

The lava capping on the top of Study Butte has a thickness of less than 100 feet (not measured), but the Big Bend shaft is 220 feet deep all in the lava. It is about at this point, however, that the lava sheet dips down and the vertical shaft is not, therefore, penetrating the sheet perpendicular to its upper and under surfaces. Should the shaft be extended through the lava, it is quite possible that bodies or flat-lying lenses of pay ore will be found in the sedimentary rock beneath.

The same would apply to the Dallas shaft, which is, in its lower part at least, in the lava.

In both shafts considerable water was encountered, the larger part of which is removed by pumps in the lower-lying Dallas shaft. This strong flow of water has been a source of difficulty in sinking.

I am indebted to Mr. W. L. Study, former superintendent of the Big Bend mine, for the following analysis of the mine water. This analysis was made by the Dearborn Drug and Chemical Co. of Chicago, W. A. Converse, analyst.

ANALYSIS OF BIG BEND MINE WATER.

	Grains in One Gallon.
Silica	2.663
Oxides of Al and Fe	trace
Carbonate of lime	trace
Sulphate of lime	60.832
Carbonate of magnesia	21.019
Sulphate of magnesia	28.600
Sulphates of sodium and potassium	138.921
Chlorides of sodium and potassium	4.950
Loss, etc.	0.325
Total	257.310

The water was highly impregnated with sulphuretted hydrogen.

In a lava hill known as Maverick Mountain, east of Study Butte, T. P. Barry and associates are also opening a vein said to carry cinnabar ore of good grade.

DEPOSITS IN SEDIMENTARY ROCKS.

In the shales and sandstones of the Upper Cretaceous (presumably the Eagle Ford formation), in Section 248, Block G 4, is a very interesting cinnabar deposit belonging to the Colquitt-Tigner Mining Company. It has been opened up by vertical shafts with drifts below and by open cuts and adits. The shales and sandstones dip at gentle angles and are cut by fractures along which the cinnabar has been deposited. The two strongest fissures noted strike one N. 70° to 75° E. and the other a little to the south N. 63° to 65° E., both being nearly vertical or dipping south at steep angles. The curious feature of this mine is a vertical pipe of oval or circular shape composed of broken up material, the horizontal diameter of the pipe being perhaps 75 feet. At the surface this pipe shows as fine gray comminuted material resembling volcanic ash, but I am informed by Dr. Phillips that a microscopic examination shows no evidence of volcanic origin. The vertical shafts are sunk, one a little west of the pipe and the other at its east border. The pipe is also penetrated by drifts from these shafts and one drift curves one-third way around it. In these drifts the pipe below may be seen to be composed of angular fragments of shale and sandstone, cemented by calcite and a bituminous substance. This bitumen runs down the sides of the drifts from cavities in the cemented material and is quite abundant. There are said to be only traces of cinnabar in the pipe itself. No volcanic material was noted in the pipe anywhere or in any of the mine workings, and no explanation of the formation of this pipe in nearly horizontal sedimentary beds occurs to the writer. About one mile to the northwest is a volcanic hill, known as Cigar Mountain. The mine deserves a careful study by a competent geologist.

The Chisos and McKinney-Parker Mines.—Another more important deposit from a commercial standpoint is found in the Eagle Ford formation at about the middle of the quicksilver belt, as previously outlined. It has been opened up by the Chisos Mining Company, operating on Section 295, Block G 4, and at the McKinney-Parker mine on Section 70, Block G 12.

The ore is cinnabar, occurring in a gangue of calcite in true fissure veins. The Eagle Ford sediments lie here also at gentle angles, and the veins cut the bedding planes at steep angles. The dip of the main vein of the Chisos mine as seen in the incline is about 70° S. E., the general strike of the vein being about N. 30° E. Most of the ore extracted is of high grade and is found in seams and in small bodies up to four feet in thickness. The ore has thus far been reduced in retorts. As the shales and sandstones on either side of the veins contain values, there is probably considerable ore of a furnace grade on the properties.

According to B. F. Hill[1] (Bull. 4), the ore also contains a little gold.

DEPOSITS IN THE LOWER CRETACEOUS.

The Lower Cretaceous rocks, as before noted, include the Vola limestone, the Del Rio shale, the Fort Worth limestone and the Edwards limestone. The first two formations are not known to contain cinnabar in commercial quantities except certain portions of the Del Rio shale, as hereafter described. These formations are therefore placed with the Eagle Ford on the map (Fig. 17), the whole constituting a non-productive series except in the area east of the Long Draw.

The Lower Cretaceous series form the mesas of the western part of the quicksilver belt or what may be designated the Terlingua district proper. From the larger part of these mesas the Vola limestone and the Del Rio shale have been eroded, so that the next underlying member, the Fort Worth limestone, forms the surface in most places. The lodes in this formation have thus far been the main source of the quicksilver of the district. However, since no sharp line can be drawn between the Fort Worth and Edwards limestones, and since the lodes extend down into the latter, they will, for the purposes of this paper, be considered as one and designated the Lower Cretaceous limestones.

The Terlingua district proper is located on the main Lower Cretaceous limestone mesa, extending from the Long Draw west to Las Tres Cuevas Hill. This mesa is cut by numerous arroyos, often formed along lines of faulting. The average altitude of the top of mesas above sea-level is about 3,300 feet. The district is bare of trees and the only available water is rain water impounded in masonry tanks or caught from the roofs of houses.

An observer, standing in a commanding position in the productive area, and looking south, will perceive a series of white-capped hills, and will also note a few similar isolated hills within the productive area, notably California Hill and Clay Mountain. These white-capped hills represent the uneroded portion of the Vola limestone and the Del Rio shale, the limestone forming the white caps, and the soft shales the slopes visible from the standpoint of the observer.

[1] Bull. 4, University of Texas Mineral Survey.

The Vola limestone contains small irregular veinlets of calcite, which presumably carry traces of cinnabar, but such seams usually break up and disappear in the underlying shale.

The Del Rio shale is, however, cut by numerous seams of a white, transversely fibrous mineral, not attacked by HCl and probably gypsum. Usually a little iron oxide, or sometimes pyrite, may be noted along the borders of these seams, and if samples are crushed and washed, cinnabar is almost always found to be present. While filling joints and fractures in all positions, the gypsum seams more often lie nearly horizontal; that is, roughly parallel to the bedding planes of the shale. The dark unaltered shale contains considerable iron di-sulphide, chiefly, if not entirely, pyrite. This is disseminated through the rock and also deposited in little veinlets and in nodules. Where these nodules are oxidized they are frequently hollow, sometimes showing a little cinnabar in the center, which may originally have been disseminated through the pyrite and subsequently concentrated during the process of oxidation. The shales immediately above the quicksilver lodes are often broken and crushed, and then usually contain cinnabar as paint on the surface of the fragments. The shales in this case are reddish and oxidized. In one instance, a horizontal layer of shale was noted, red and oxidized in one part and dark in color and unoxidized in another.

The massive Lower Cretaceous limestones contain all the profitable lodes of the mesa. On the map (Fig. 1) several of the stronger lodes are shown, but there are many others. While not parallel, their strike is in a general northeast to southwest direction, the dip being approximately vertical. The lodes are distinctly of the nature of fissure veins and are mineralized lines of faulting, along which the thrusts have been largely horizontal This is clearly shown by the prevalent horizontal groovings on the walls of the lodes. There have been, however, small vertical throws, resulting at some points in the dropping down of masses of the Del Rio shale between lime walls below. This is finely seen on the Margaret D. lode and in shaft No. 1 on the property of the Marfa and Mariposa Co. The latter shaft is 50 feet deep, the lower part being in a crushed body of dark shale, and the collar on a level with the top of the surrounding lime country rock. This shale is sharply separated by movement walls from the adjoining lime and is apparently in every way similar to the Del Rio shale in general, except in being much crushed. Cross-cuts show this shale body below to have a width of about twelve feet. As a rule, where the shale has been faulted down, it is reddish and oxidized, often containing enough cinnabar to form a low grade ore.

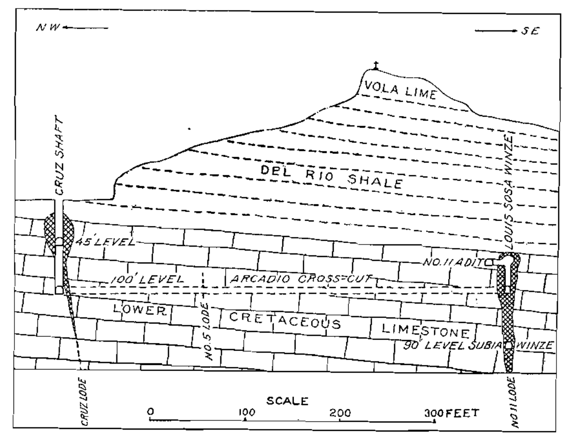
It would then appear that the massive Lower Cretaceous limestones were divided by vertical northeast to southwest fractures into a nearly parallel series of blocks and wedges, and that horizontal movements took place, grinding up the limestone along these fractures and forming in some places masses of friction-breccia and in other places open spaces. The fracturing and horizontal thrusts were presumably the result of the same stresses and perhaps concomitant. These stresses evidently exerted a much slighter effect on the overlying Del Rio shale, as may be well seen in the uneroded bodies of this shale in California Hill, the fractures practically dying out in the lower part of the shale body.

The Lower Cretaceous lodes may be divided into two kinds, according to the composition of the vein matter:

1. Friction-breccia lodes.
2. Calcite lodes.

In the friction-breccia lodes the vein-matter is clearly made up of triturated and crushed limestone and shale, cemented by calcite and gypsum, and originally containing much iron di-sulphide, which in nearly all cases has since been oxidized. In the unoxidized crushed lime of some parts of the 300-foot level, main shaft, of the Marfa and Mariposa Co., pyrite and cinnabar are both present. These friction-breccia lodes are by far the most important commercially, as may readily be seen by examining the mine dumps. Two of the most important of these lodes, No. 11 and No. 5, are shown on the map. The broken up vein matter formed a ready avenue for the ascent of solutions and gases containing the values, as well as a convenient place for deposition. These lodes tighten up in depth in the great majority of cases and are not then profitable.

Fig. 17 shows a vertical northwest to southeast section of California Hill through the Cruz shaft and the Louis Sosa winze. This section cuts the Cruz lode and No. 11 lode. It will be observed that these lodes are shown as ending upwards at the Del Rio shale. This material, being more or less impervious to the solutions, appears to have acted as a barrier and to have caused the deposition of the cinnabar directly under it, and it is in exactly this position that all of the large and rich ore bodies have



VERTICAL SECTION CALIFORNIA HILL, TERLINGUA

FIG. 17.

thus far been found. In some cases exploitation in depth directly below these rich bodies has proven the existence of ore of a good but lower grade to the depth of about 100 feet, with the ore still going down; in other cases, the vein pinches and the ore gives out.

Of all the lodes exploited, No. 11 is apparently the most promising. This in part follows along a dike of intrusive rock to be hereafter described. The fracture followed by this lode shows the greatest amount of crushing and movement, and this fact, taken in connection with the proximity of the dike, suggests that it may continue and be profitable to a considerable depth. A bore hole sunk with a churn drill to the depth of 446 feet on this fissure shows lode material in the bottom.

As is well known, movements resulting in the formation of fissures have usually taken place in a vertical or highly inclined direction and such fissures when strong and of a considerable horizontal extent, may reasonably be expected to continue to a great depth. But with fissures formed by horizontal thrusts, the case is not so clear, and it would appear that they are much less likely to be continued to great depths. It is certainly the case that many of the smaller lodes of the Lower Cretaceous limestones at Terlingua do pinch out in depth. This interesting question will doubtless be settled by the vigorous exploration now going on on the property of the Marfa and Mariposa Co., whose deepest shaft is now down 300 feet. A drift from this shaft has encountered an oxidized lode carrying cinnabar and precisely similar to some of the surface lodes.

The fact of a lode pinching below is not always an indication that it has given out, for some of the stronger lodes repeatedly pinch and open out again both vertically and horizontally. A case of local horizontal pinching is seen with No. 5 lode where it is cut by the Arcadio drift (see section of California Hill, Fig. 18). At the point marked No. 5 on the vertical section, there is no indication of a vertical seam, yet to the east in the bottom of the Tercero shaft, the lode is still strong and the bottom of this shaft is 60 feet or more vertically below the Arcadio drift. No. 5 lode is also strong west of the Arcadio drift.

Calcite Lodes.—In many of the lodes the chief vein matter is calcite. The strongest one of this character in the district is the Margaret D. on Sections 41 and 40. This lode has a strike about N. 75° E. and a nearly vertical dip, the width varying from 2 to 10 feet. It is over a mile in length. The calcite in this typical fissure vein is largely deposited in layers parallel to the walls, forming a striking example of banded structure. At many points ground-up material and irregular masses of shale faulted down (in one case 30 feet) may be noted. Considerable ore of a one per cent. or lower grade has been extracted from this lode, the better ore being associated with the shale and ground-up material. A large amount of the white calcite contains cinnabar which forms a very pretty ore, the bright red cinnabar contrasting strongly in color with the white calcite. Such ore is deceptive in appearance and usually contains less mercury than one would suppose, much of it averaging only one-fourth per cent. mercury. On account of the poor breaking qualities of the calcite, such ore is not at present profitable. In addition to cinnabar, the Margaret D. lode contains small amounts of an oxychloride of mercury, known as Terlinguaite, and of a volatile hydrocarbon.

Taken as a whole, the lodes composed largely of calcite have not thus far proved very profitable, although occasionally good are bodies of limited dimensions have been encountered, as on the Excelsior lode at the Colquitt-Tigner mine, and on the José lode on the Marfa and Mariposa property.

Tierra Lode.—On section 38 is a strong lode over 2,500 feet in length, composed in part of red shaly material (locally known as *jaboncillo*) and in part of calcite, along which movements have taken place apparently in part subsequent to the time of its formation, resulting in a series of cracks, some lying nearly parallel to the lode (that is, dipping southeast about 80°), and some nearly vertical. Surface waters percolating downward along these fractures have dissolved out more or less of the calcite of the lode and to some extent the adjoining limestone, forming open fissures and caves. The main open fissure was formed along the middle line of the vein, so that it is bordered on either side by more or less vein matter. This main open fissure has been followed horizontally by drifts from the Lafarelle shaft for a distance of 460 feet. The fissure varies in width from a fraction of an inch to several feet, and has to a greater or less extent been filled with loose material washed down from above, and its vertical extent exceeds 150 feet, for it continues down below the 150-foot level of the Lafarelle shaft. On the 100-level and 150-level bones and teeth of extinct mammals were found imbedded in the detritus. These bones and teeth were examined by Prof. J. C. Merriam, of the University of California, who states that some of them are the remains of an extinct ground sloth, and that some of the teeth are horse teeth of an extinct species. The age indicated by the remains is probably Pliocene.

A little to the east of the Lafarelle shaft this lode originally contained a body of good cinnabar ore in a soft matrix. This material, gradually disintegrating, enriched the detritus to such an extent as to form ore containing from one-half per cent. to 4 per cent. mercury. Numerous boulders of nearly pure cinnabar were found in it. Remnants of the original ore body in the vein proper are found alongside of this tierra ore. About 500 tons of this ore have been extracted, and it continues down below the 150-foot level, although there of lower grade.

Period of Vertical Faulting.—After the period of horizontal faulting and probably subsequent to the main period of ore deposition, the Lower Cretaceous limestones and overlying sediments were cut by a series of northwest to southeast fractures, along which vertical or highly inclined thrusts have taken place. On the map several of the stronger of these faults are shown. In case of the fault shown as southwest of California Hill, groovings are still plainly to be seen on the escarpment, these groovings being inclined to the southeast about 45°. On many of the fault-walls patches of the friction-breccia still adhere. No finer examples of the direct influence of faulting on topography can be seen than in the Terlingua district, where many of the cliffs are due directly to faulting, portions of the original fault fractures being so well preserved as to convince the most skeptical.

Joints.—The Lower Cretaceous limestones are intersected by abundant vertical joints with a northwest to southeast strike or at right angles to the trend of the lodes. These joints are often strongly developed (see Fig. 18). Frequently calcite is deposited along them and at some points, where movement has taken place small ore bodies have formed. These joints do not appear to have exerted any influence on ore deposition where they intersect the lodes, as they seem to be as well developed where no ore is found as where the values occur. At a few points, however, cinnabar may be noted in these joints or crossings, where they intersect a barren part of a lode.

Igneous Rocks.—In the Terlingua district proper, lava or porphyry has been found at but two points, namely California Hill and Black Peak, close to the Clay Mountain. The Texas Survey likewise describe a rhyolite as occurring in the interior

portion of the Black Mesa as a laccolith, but this is outside of the zone where deposits of commercial value have been found. The lava of Black Peak is basic in character and shows porphy-

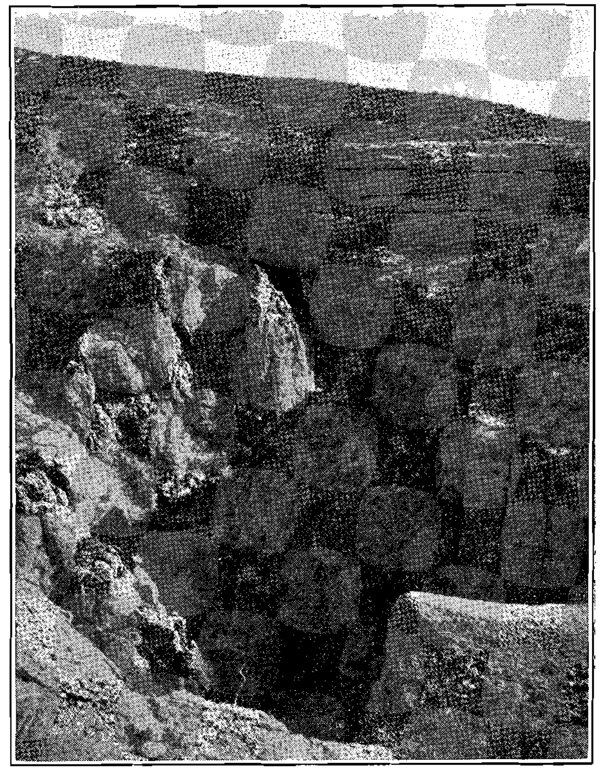


FIG. 18. View in Croesus Canyon near the Mariposa furnace showing horizontal bedding and vertical jointing in the lower Cretaceous limestone.

ritic greenish crystals, said by B. F. Hill to be olivine. Hill calls the rock a basalt. The lava or porphyry of California Hill when examined under the microscope is seen to be an andesite. Macroscopically, the rock is, when fresh, hard and fine grained, of a greenish color and showing numerous phenocrysts of hornblende.

Origin of the Ore Deposits.—The richest ore bodies of any size have thus far been found under California Hill or within 1,000 feet of it, although good bodies up to $15,000 or more in value have been extracted from section 38, two miles distant in an air line.

California Hill is penetrated by at least two dikes of andesite, which in places have spread out between the strata as intrusive sheets. One of these sheets now forms the top of the middle portion of the hill, the rocks formerly overlying it having been eroded. The southwest portion of No. 11 lode follows one of these dikes, which is here much oxidized and contains cinnabar. At one point a pocket of solid cinnabar, perhaps five feet in diameter, was found at the contact of the dike and the adjoining limestone. As a rule, however, exploration of the dike has not shown up ore of value.

The source of the cinnabar is a matter of conjecture, but there is little doubt that it was deposited in its present position by ascending hot water, containing it in solution and probably also by sublimation from gases. The occurrence of the best ore bodies in the vicinity of the intrusive rock suggests that it may have furnished the heat, and was thus the primary cause of the formation of the heated solutions and gases which transported the mercury from below up through the fault-fractures and deposited the same therein. Very likely a careful chemical examination of the fresh andesite would show no traces of mercury, that rock having been rather an agent in the transportation of the ore than a source of it.

Production.—The following companies have been or are operating on lodes in the Lower Cretaceous limestones: The Marfa and Mariposa Mining Co., The Terlingua Mining Co., The Colquitt-Tigner Mining Co., The Texas Cinnabar Mining Co., The Lone Star Mining Co.

Of these only the first three have reached the productive stage. The total product of the mines up to December 31, 1905, is not far from 25,000 flasks, the Marfa and Mariposa leading with about 20,000 flasks to its credit.

MINERALS OF THE QUICKSILVER LODES.

Calcite.—Calcite is by far the most prevalent vein mineral throughout the entire zone of quicksilver deposits. It occurs as an original deposit and as a lining to caves in the lodes, these caves being of later origin than the lodes. It is crystallized in a variety of forms. Some groups of dog-tooth spar crystals in cavities contain cinnabar in their interior, and if these cavities, as is likely, were formed after the lodes, it would appear that some of the cinnabar was deposited at a time subsequent to the main deposits.

Gypsum.—Sulphate of lime or gypsum is very abundant in the friction-breccia lodes, and is regarded as a secondary mineral formed during the period of oxidation, the sulphur being set free in the oxidation of the pyrite. In one cave, lined with curled stalagmite-like growths and crystals of gypsum, the gypsum appears to be forming at the present time. In the bottom of this picturesque cave there is clear water nearly saturated with mineral matter, giving it a bitter taste. The temperature of the cave is high.

Aragonite.—According to B. F. Hill, aragonite is common in the lodes west of the Terlingua post office.

Chalcedonic Quartz.—Silica in any form has not been noted in the profitable lodes in limestone, but occurs as a coating on lava fragments along a calcite vein that cuts across the lava cap of California Hill. It is also found in some lodes near the Black Mesa and at other points.

Iron Disulphide.—As already noted, iron disulphide (in part at least pyrite) is common in the Del Rio shale and in unoxidized lode material from below. It was undoubtedly present in all of the friction-breccia lodes, but has undergone oxidation. In the cinnabar deposit of Study Butte it is very abundant in the lava.

Hematite and Limonite.—In the oxidized lodes, hematite and limonite are abundant.

Black Oxide of Manganese.—As a coloring to calcite, black oxide of manganese is occasionally found.

Hydrocarbons.—The nearly universal presence of hydrocarbons in quicksilver lodes has never been satisfactorily explained. It is rare in the lodes of the Terlingua Lower Cretaceous limestones, but is found in the calcite of the Margaret D. lode and in the black shale of shaft No. 1, on the property of the Marfa and

Mariposa Mining Co. Its abundance in the peculiar pipe of the Tigner mine on section 248 has already been noted.

Cinnabar.—All of the mines contain cinnabar as the most abundant mercury mineral. It is usually in a granular form, but locally occurs in well-formed crystals.

Oxychlorides.—In the lodes of the Lower Cretaceous, particularly in the Tercero shaft of No. 5 lode, oxychlorides of mercury, in association with native mercury, are abundant. Many tons of ore have been reduced in which they form the values. These oxychlorides are new species and have been described by Prof. Alfred J. Moses, of Columbia University, N. Y. City (see Bibliography).

Terlinguaite is the most abundant oxychloride. It is found not only in the Tercero shaft, but in other places in No. 5 lode, as well as sparingly in the Margaret D. calcite lode and elsewhere. It occurs chiefly in an earthy form, mixed with gypsum and other impurities. One cave in the Tercero shaft workings was nearly filled with white granular gypsum containing streaks of terlinguaite. Occasionally both cinnabar and terlinguaite are found in the same hand specimen, but this is not usual.

Eglestonite occurs chiefly as well-formed crystals lining cavities, which may also contain native mercury, terlinguaite and calomel.

Montroydite is quite rare, but occurs in association with the other oxychlorides.

Calomel.—Chloride of mercury or calomel is found as a white bloom on ore fragments and also as crystals, which are often rectangular in shape with truncated corners. These crystals are colorless and transparent.

Fluorspar.—According to B. F. Hill, fluorspar has been found in the lodes, but has not been observed by the writer.

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