

pebble is elevated to a screen delivering to a shipping chute, the small ore being returned to the roughing rolls. The clean fine runs into the fine bin which is heated by exhaust steam. The fine middling is elevated to the roughing rolls. The crushed ore, after passing through rough rolls, meets the No. 2 lump which has passed the roll-jaw breaker, and the product from the fine-crushing centrifugal rolls, and is elevated to a two-unit centri-pact screen. The upper screen is  $2\frac{3}{8}$ -in. aperture, and the oversize goes to the roughing rolls; the second screen is  $\frac{7}{8}$  in., and the oversize goes to the fine rolls; the through size goes to the fine jigs (which are of two compartments), jig through a bed of iron balls, and discharge into the fine bin. The installation of spiral slate-pickers (to rough-pick the  $1\frac{1}{2}$ -in. pebble-ore) is being considered.

All the chutes and bins discharge direct into 10-ton narrow-gage cars, in which the ore is hauled over the road of the company to the shipping points on the Potomac and the Washington Southern Railroad, six miles distant from the mine.

### Mercury in Tuscany.

According to British Foreign Office Report, No. 633, Misc. Series, the output of mercury in Tuscany in 1904 amounted to 355 metric tons, valued at about £80,000, and the indications are that it is likely to increase. The most important mine is Siele, near Castell, Azzara. Other mines have recently been opened at Badia, San Salvatore, and at Monteburano. The mine at Cortevicchia continues to produce regularly. On a belt of land, starting at Monte Amiata and extending southward to Capita, there are found at intervals indications of mercury.

One of the principal difficulties in the operation of the ordinary type of suction producer is the maintenance of a sufficiently uniform quality of gas to insure the correct explosive mixture at the engine cylinder. This is especially the case where the load is at all variable, and is often so serious that many makers will not recommend the use of suction producers, unless the load to be carried is fairly steady. The chief cause of this variation in the quality of the gas is that the percentage of steam carried by the blast is not constant, the percentage of hydrogen in the gas varying accordingly.

The method of obtaining alumina and alkali from such rich silicates as leucite, according to the Levi process, is designed to extract the mineral with a hot alkaline or alkaline-earth solution from which the alkali and alumina are subsequently recovered (British patent 13,875).

The synthesis of water, by the influence of radium emanation, has been recently accomplished.

## Ore Deposits of the Sierra De Los Caballos.

BY CHARLES R. KEYES.\*

The Sierra de los Caballos is a formidable block mountain in south central New Mexico. This range is about 30 miles long, and is washed by the Rio Grande on the west. It rises abruptly to an elevation of over 4,000 ft., or about 8,000 ft. above sea-level.

For many years copper has been mined on the west side of the range, but owing to inadequate transportation facilities the development has not been what it would be under more favorable conditions. The ore has to be packed on burros over the

of good coking coal; so there are good conditions for an independent smelting enterprise, the main line of the Santa Fé railroad being only 12 miles away. The new lead camp thus promises to be prosperous from the start.

The Sierra de los Caballos and the Sierra Fra Cristobal, to the north, form the rugged western boundary of the vast level area known as the *Jornada del Muerto*, or the Journey of Death, a name given by the early Spanish explorers. The west side of the range forms a sheer precipice of nearly 2,000 ft., which rises above the steep talus leading up from the Rio Grande to an elevation of 1,500 to 2,000 ft. from its base. On the east side of the

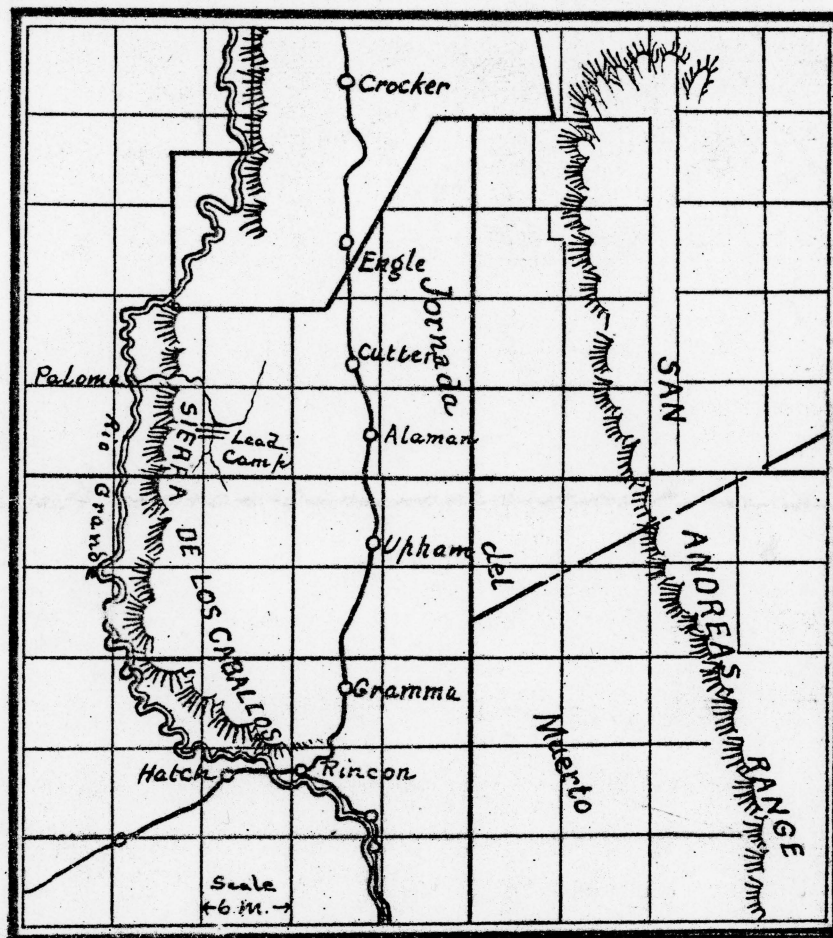


FIG. 1. SIERRA DE LOS CABALLOS.

range and then hauled in wagons 20 miles to railroad.

During the last two years gold has been exploited more or less extensively, principally at the mouth of Apache cañon. A rather full account of this new placer field was given in this JOURNAL (December 24, 1903, page 966).

Within the year another camp has been opened which is more promising than any of the others. This is on the east side of the mountains, under the highest point (Timber Peak). The deposits are lead ores; there are in the vicinity also gold and copper prospects. Lime and iron abound in the neighborhood, and plenty

range the general slope is that of a stratum-plane inclined about  $20^\circ$ , away from the mountain.

The eastern slope of the range is rough, owing to the rapid corrosion of the drainage-ways which reach the Rio Grande, 800 to 1,000 ft. below the general level of the plain. The gradient of these arroyos is over 100 ft. in the mile. A strip of country, four miles wide on the average and 20 miles long, on the east flank of the range, drains into the Rio Grande through Las Palomas gap, a deep box-cañon that cuts the range in two. This belt of country is faulted in many places. It is traversed by basic dikes and is altogether a rough bit of country, though easily accessible by wagon. The cañons are

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numerous and labyrinthine. Mescal cañon and Palomas cañon are the master drainage-ways into which all others empty before their waters cross the mountain axis and fall into the Rio Grande.

All the tops of the hills in this rough strip are nearly on a level, which is the same as that of the general surface of the Jornada plain projected westward from its middle line. Consequently, when viewed from the railway train at a distance of a dozen miles, the surface of the

stones to the top of the range, have been entirely removed through erosion down to the foot of the mountain, where they abruptly rise several hundred feet above the bed of the arroyo.

The geological age of the limestone is for the most part late Carboniferous. It is possible, however, that 100 or 200 ft. of the lowermost beds will eventually prove to be early Carboniferous, as has been fully demonstrated in neighboring ranges.

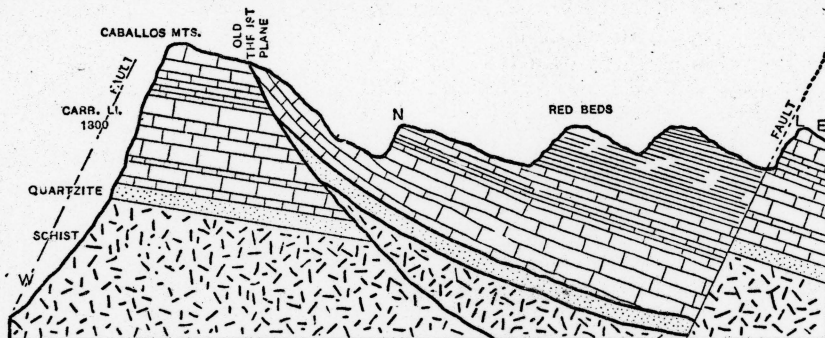


FIG. 2. GEOLOGICAL SECTION IN LOS CABALLOS.

plain appears to be unbroken to the very foot of the mountains, and to merge with its talus-slope that reaches down from the more precipitous portions.

The main drainage-way (in the valley of which the new lead camp is situated) runs northward at the foot of a broad incline plain, on which the main vein outcrops are situated. It drains a tract of country to the south of some 20 sq. miles, most of which is rather gentle mountain slope. At a point about a mile north of the camp the arroyo turns abruptly to the west, passes through a deep cleft in the Caballos range (called Las Palomas Gap) and reaches the Rio Grande. There is a deep valley between the crest of the incline plain and the main ridge of the Caballos, which opens into the arroyo just mentioned a short distance from the point where the latter passes into the box-cañon portion of its course. The general geological section of the Caballos mountains is given herewith:

- |  | Feet. |
|--|-------|
| 5. Sandstone, yellow, and coal-bearing shale of Cretaceous age (exposed to the eastward, but entirely eroded from the mountains).....        | 2,000 |
| 4. Shale and sandstone, bright red in color, the 'Red Beds' (of Triassic and Carboniferous age), well exposed at the east foot of the range. | 800   |
| 3. Limestones, blue, white and dark-colored, in different layers, fossiliferous, Carboniferous in age (exposed in the mountain face).....    | 1,500 |
| 2. Quartzite, probably of Carboniferous age.   | 100   |
| 1. Schist (biotitic), gneiss (crumpled), and red granites, probably of Proterozoic age (exposed).....  | 1,000 |

The country rock, which the ore-veins cut on the stratum surface, is a dark blue, rather brittle, compact limestone, which is the surface rock of all the eastern slope of the Caballos mountains. The stratum-plane on which the veins are best exposed is the uppermost layer of the limestone formation. From this surface the 'Red Beds,' which once covered the lime-

The relationship of the several geological formations, and the character of the faulting connected with the uprising of the mountain block, are shown in cross-section in the accompanying diagram.

The line of the section is along one of the main veins, the trend of which is nearly at right angles to the axis of the range. The thrust-plane shows a vertical displacement of at least 1,200 ft. No orebodies are connected with it. Its formation antedates very much the formation of any of the orebodies of the district. The main fault on the west side of the mountain-block has a throw of more than 4,000 ft.; and there is evidence of additional faulting to the westward, making the total displacement very much greater.

From the mountain top the dip of the

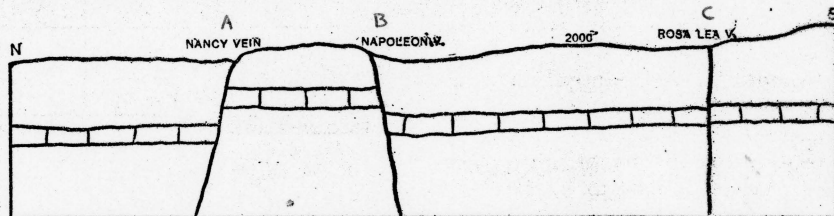


FIG. 3. FAULTING IN LOS CABALLOS.

beds is to the eastward at a rapid rate. The beds, however, soon seem to flatten out and then to rise again 30 miles to the eastward to the crest of the San Andreas range. While the general arrangement of the beds between the two ranges mentioned is that of a broad synclinal trough, the local dips are much greater than the surface of the plain, which is thus worn out on the beveled edges of all underlying indurated strata.

The section (shown in Fig. 3) gives the structure in the neighborhood of the lead camp, as viewed at right angles to the

trend of the ore-veins. The orebodies occupy the lines of faulting, both in the cases mentioned and in others in the neighborhood. The displacement in the Nancy fault (A) is about 100 ft. At the Napoleon fault (B) the drop is about 40 ft. On the Rosa Lee fault (C) the throw is somewhat less, and is not as yet accurately determined.

The ores are contained in what appear to be true 'fissure veins,' which have been formed along fault planes; without doubt they extend to a great depth. Most of the veins consist of extensive plates of ore, which are remarkably uniform in thickness and of nearly vertical position. The general trend of the veins is east and west, or nearly at right angles to the axis of the mountain range.

The surface exposure of the veins on the east side of the range is along the upper stratum-plane of the limestone. On the west side of the range the exposures of the visible veins are normal to the stratum-plane or along the broken edges of the rockbeds. The stratigraphical position of the vein-outcrops on the east side of the range is, therefore, at the top of the limestone, here 1,500 ft. thick. The position of the outcroppings of the veins on the west side of the range is at, and below, the bottom of the limestone.

The vertical distribution of the ore is of unusual interest. The ore at the top of the limestone on the east side of the range is a galena carrying a small amount of silver. At the bottom of the limestone, 1,500 ft. beneath, and in the underlying quartzite, the ore is chiefly chalcopryrite and bornite, with practically no malachite or azurite. The copper ores have their best development in the quartzite, though they extend upward into the limestone and downward into the old crystalline basement composed of gneiss, schist and ancient intruded granite. Below the quartzite, the veins appear to become gold

bearing. It is thought that the rich gold placers which are found along the west side of the range have been derived largely from this zone.

The gangue of the orebodies consists chiefly of barite, fluorite and quartz. At a depth of 300 ft. from the surface of the limestone, copper begins to appear associated with the lead. The surface alteration extends to a depth of only a few feet. In this surface zone fine wulfenite crystals occur.

The largest vein is exposed, unbroken on the surface, for a distance of 2,000 ft.



It no doubt extends farther in an eastward direction, but is covered by gravel and sand of the arroyo and the 'Red Beds.' At its widest point it measures 22 ft., and nowhere is it observed less than 4 ft. The vertically exposed depth of the vein is probably over 300 ft. An adjoining vein is 8 ft. in width at the points where two shafts have been sunk. Other veins are 3 to 4 ft. in width. Judging from the geologic conditions, it is reasonable to expect that the fault-planes, on which these veins are opened, extend entirely through the limestone formation into the ancient crystalline basement beneath.

The principal properties are now being developed by the Southwestern Lead & Coal Company under the general management of Max. B. Fitch. A complete electric plant is being erected on the coal property, and all the power for the mill will be conducted by wire a distance of four miles. The concentrating plant will have a capacity at first of 50 tons per day.

### The Collie Coalfield.

An important report has been made upon the position and prospects of this field, of West Australia, by Dr. R. Logan Jack, the Royal Commissioner. This field comprises about 50 square miles in area, and lies south of Perth.

The coal-bearing strata are not the equivalent of the Newcastle beds of New South Wales, but are of considerably later age—a point of some importance in view of the fact that it is with New South Wales coal that the Collie coal has chiefly to compete. There are estimated to be over 300 millions of tons of workable coal in the field, often in thick seams, the thickest of which, the Wallsend seam, sometimes reaches 17 ft. Only about 6 to 9 ft. of these thick seams can be profitably extracted, and, owing to the friable nature of the coal, about 60% has to be left for support, and the proportion of small coal is excessive.

Mining is carried on by adits from the outcrop, involving a large amount of underground haulage. The coals are semi-bituminous and non-caking. They do not store well, even briquettes being found to be liable to spontaneous combustion. Compared with New South Wales coal, the Collie coals are distinctly inferior for steam-raising purposes. It takes  $1\frac{1}{3}$  tons of Collie coal to do the work of one ton of New South Wales coal.

The new Chilean railway line from Arica to La Paz will be connected with the important mining center of Oruro, at present only to be reached from the sea coast by the line from Antofagasta, a distance of 560 miles. The new route from Arica will be about 280 miles.

A steel containing 4.99% vanadium and 1.084% carbon, failed at 140,596 lb. per sq. inch.

## Standard Screens for Screen

### Analysis.

BY COURTENAY DE KALB.\*

The movement of the Institution of Mining and Metallurgy in the direction of standardization of screens is welcome; the necessity for uniform standards is appreciated by those who realize the importance of a sure basis for the interchange of professional experience. Engineers are,

the fact of error, but also the measure of it. Therefore, I favor the adoption of a series of screens whose successive apertures shall increase by arithmetic progression.

The suggested table of standard screens, issued by the committee on standardization of the Institution of Mining and Metallurgy, possesses the unfortunate difficulty of not conforming to either arithmetic or geometric progression. The curve (plotted

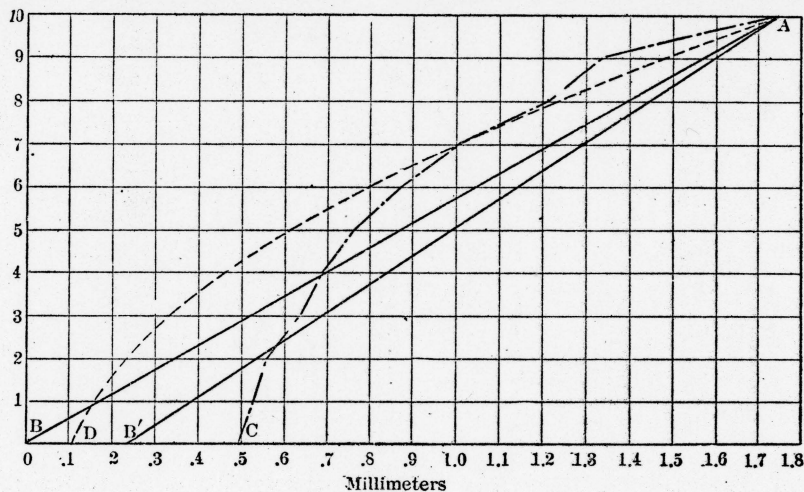


FIG. 1.

of course, familiar with the efforts of Rittinger, Richards, Waggoner and others, to develop a scientific and practicable series of screens for the analysis of crushed ore. The great difficulty of the problem is that of economical manufacture, although it must be confessed there is a disparity of view among engineers as to what conditions the curve representing successive diameters of opening should fulfil.

The chief objection to the logarithmic plot is that it does not convey any immediately intelligible impression to the mind of the majority of men who are engaged in the treatment of ores, while any

from the committee's table) is shown by the line *AC*, Fig. 1, including meshes 30 to 8. I suggest that the efforts of the committee would be worthily employed in the investigation of a possible series conforming to an arithmetic progression, or, at any rate, to some curve whose law can be expressed by an equation.

The committee has evidently felt the limitations of the standard screens, previously suggested, in respect to the small number of sieves in the series; this is characteristic of those schemes which depend upon geometric progression. There is no question that, the smaller the difference between successive quantities of pulp,

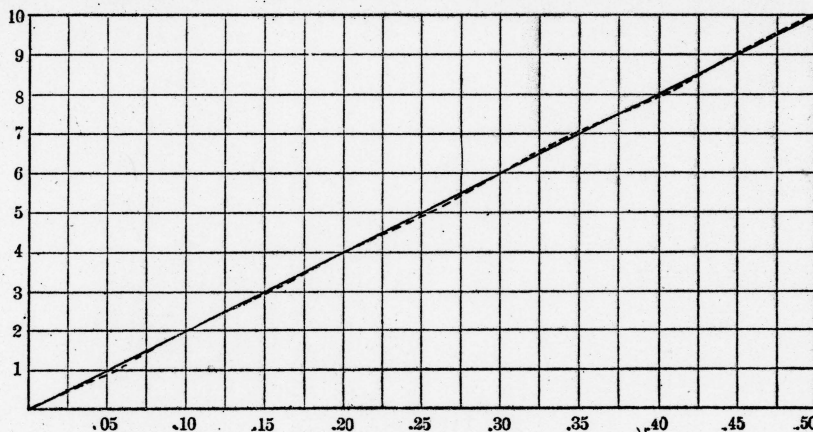


FIG. 2.

intelligent man can appreciate the significance of the law expressed by a straight line, and any divergence from that law (as shown by the plot of his results) conveys at once to his understanding not only

the more exact will the analysis be. On the other hand, anyone who has done much of this sort of work will realize the enormous amount of labor required if the number of sieves in the series is too great, and it seems to me that the number suggested by the committee is excessive.

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