

## VI. ON THE ORIGIN OF CERTAIN WIDE VEINS

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The true fissure vein has come to be regarded as a deposit in deep fissures through which essentially water solutions ascend and precipitate their mineral content in the fissure. These solutions are thought to have their origin in the concentrated mineralized differentiates from the magma. In some places certain veins are very wide ranging from 30-100 feet or more in width. For certain examples of such veins J. E. Spurr\* has recently advanced the theory that they are actually intruded magmatic extracts of a sufficiently viscous nature to carry suspended fragments upward during the intrusion and are thus found after the congealing of the intrusion in an apparently unsupported state, at the time the magma congealed.

It is also held by Spurr that the great width of some of these veins is due to the pressure exerted upon the walls of the fissure at the time of intrusion of the vein *dike*, the walls being forced apart by the pressure of the intrusion. Certain examples cited by Spurr as being typical "vein *dike*" intrusions include the wide vein at Tepezala, Aguas Calientes, Mexico. An opportunity was afforded the writer to study these veins in considerable detail as well as the other veins of the same mining district at Asientos.

Four types of veins can be differentiated, in the Asientos-Tepezala district, namely, (1) the Tepezala veins cutting a rhyolite porphyry and extending into limestone which was intruded by the porphyry, (2) veins cutting a soft sericite schist on which rest the limestone mentioned as erosion remanants—the Panuela-Socorro- Sta. Clara vein system, (3) the Sta. Francisca Vein at Asientos a wide vein, composed of brecciated rhyolite and finally, (4) The Orito vein, a wide brecciated vein zone in limestone.

In type one, the wide portion of the vein is found in the limestone and where the vein enters porphyry it becomes narrow and barren. This vein has an hedenbergite gangue, many interesting fine veinlets and small vugs in central part of the veinlets. In type 2, in soft sericite schists the vein will be long and narrow lense like and ore occurs only where the limestone forms one of the walls. Thus the Panuela, the Socorro, and the Sta.

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Clara mines located on this vein are found where the overlying faulted limestone blocks form one of the walls.

In type three the Sta. Francisca vein is a brecciated zone of rhyolite 40 feet wide, with both walls of the same material. The ore minerals, essentially silver, with quartz gangue surround the rhyolite fragments in successive layers. The fourth type, the Orito vein, is approximately 100 feet wide at the surface with distinct walls of limestone. Between the walls is brecciated limestone the same as the wall rock which has in part been replaced by ore, banding of fragments is common as is successive banding filling spaces between fragments.

It is apparent that the wide veins in the district form brecciated shear zones of the faulted country rock rather than single veins. The brecciation of the country rock within the shear zone has caused an increase in volume of the brecciated materials which in the case of the limestone or rhyolite has been competent to force apart the walls of the shear zones and thus develop porous zones which formed channels for upward rising mineral solutions. These wide veins or shear zones were thus formed by faulting and the walls were kept apart or perhaps partly forced apart due to the increase in volume of the materials of the zone on being broken up into fragments. That there is an increase in volume or materials on being broken seems a self evident fact. This is taken advantage of in various mining operations as overhand stoping and must always be taken into consideration in the filling of stopes, etc. Large fragments of country rock was in fact observed by Spurr in the Santa Francisca Vein<sup>1</sup>, who<sup>2</sup> also notes that inclusions of wall exist in the veins at Tepezala. It does not seem therefore, necessary so far as the veins are concerned in this district, to invoke the rather indefinite force of "Telluric pressure"<sup>3</sup> of the vein forming solutions to keep the wall apart during the deposition of the vein materials. In a brecciated zone thus produced by faulting, more or less open space would result which would more likely be arranged somewhat parallel to the main walls of the zone. In such open spaces banding would result which appear to be parallel to the walls. Also in the more intimately brecciated portion replacement may not be complete in which case wall rock fragments will be found and which now may appear unsupported as they are surrounded by vein filling. In a brecciated vein zone such fragments could hardly be oriented with the wall rock of the vein nor could they always be expected to be surrounded but may also be angular as

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<sup>1</sup>Loc. Cit. p. 283, <sup>2</sup> loc. cit. p. 280. <sup>3</sup> loc. cit. p. 281.

has recently been pointed out by Bateman. It should also be noted that the wide veins of the district are found only in the more competent rocks such as the limestone and not in the softer schist areas where faulting of equal magnitude is present. In the schist the fault fissures are narrow and the fault movement has yielded finely comminuted materials now forming gouge along the vein walls. If the veins be due to vein-dike intrusions, it would seem that the widest veins might be expected to form in the more readily yielding rock such as the schist.

The mineralization, furthermore, in a vein-dike could hardly be influenced by the wall rock to any great extent such as is known to exist in many wide veins and to which the Tepezala veins are no exception. This is strikingly shown in the San Pedro vein at Tepezala in which the ore bodies are found at the north end of the fissure only where the walls are limestone while the vein is barren to the south where it cuts the schistose porphyry. Similarly selective precipitation has taken place in the fissures cutting the schist where ore bodies are found only where limestone is present and forms one of the walls. At depth, below the limestone, the ore deposition has not taken place as is shown in the Panuela, the Socorro, and the Santa Clara mines. Continuation of the fissures into the soft schist where both walls are of this material the veins are barren and narrow. Furthermore vugs could hardly be expected in vein dikes as such are not known in dikes nor often in pegmatic dikes. It seems, therefore, unlikely that certain wide veins are vein dikes and that these are more simply and reasonably explained by narrow brecciated fault zones which have served as channels for ascending solutions and in the interstitial spaces of which the mineral content has been precipitated while at the same time replacement of the brecciated mass was also operative.