difficulty they also passed through the body of the solid granite and brought about changes in its mineral composition.

The paragenesis of the minerals has left a record of the changing character of these emanations; first of high temperature and a composition rich in soda, and containing some of the rare earth elements; they were later rich in fluorine and many other elements; while still later and as the temperature fell carbonates formed.

This progress of post-consolidation mineral formation here illustrated is so similar to that described by others that it is believed that it can now be considered as one of the normal accompanying features of large scale intrusion. The effects of these emanations must be sought in the study of all intrusive rocks.

I know not what part of these emanations were volatile and what part liquid. Thus the words "pneumatolytic" and "hydrothermal" have been avoided. Deuteric minerals illustrate, however, as do the widely disseminated minerals of contact metamorphic zones, the power of these igneous emanations to pervade solid rock without visible channel or fissure, a fact to which Kemp, for example, has already called attention.[41]

FAMOUS MINERAL LOCALITIES: CRESTMORE, RIVERSIDE COUNTY, CALIFORNIA

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The place known as Crestmore is a suburban station situated a few miles west of Riverside, and is easily reached in a few minutes by electric train or auto. Its proximity to the city makes it one of the most convenient of collecting places, because the full day can be utilized at the quarry and even the boxing and shipment of the material can be done there.

The Riverside Portland Cement Company has its plant here, and uses both the limestone and the underlying granodiorite for its manufacture of cement. During active work with its constant blasting, a permit should be obtained to go on the floor of the quarries but this is freely given by the officials and no objection is made to the amount of material collected and shipped.

The mass of limestone appears as two contiguous hills, separated by a narrow swale, and joined by a lower ridge, and the hills rise a few hundred feet above the surrounding plain. The south hill,

[41] Kemp, J. F.; The pegmatites: *Econ. Geology*, vol. **19**, pp. 711–712 (1924).

locally characterized as the "Chino Hill" from its pure white crystalline limestone, presents nothing of special interest to the collector. It is a fine to coarse grained crystalline marble having few associated minerals developed within it. An occasional specimen of columnar wollastonite has been found, and at the south end of the quarry the rock grades into a dark gray brucitic limestone with much graphite. The north hill, on the contrary, contains a wonderful array of minerals formed by contact and hydrothermal metamorphism. The abundance of blue calcite in this hill gave it the distinguishing name, "Sky Blue Hill." The large "Commercial" quarry on the east side of this hill has yielded practically all the minerals listed from Crestmore. The original limestone was either highly silicious or, what seems more probable, was interbedded with sandstone, and the whole mass was metamorphosed by its contact with the granodiorite. Later intrusions of narrow dikes of monzonite, aplite and pegmatite veins, accompanied or followed by solutions, brought about a complete change in the crystallization, composition and structure. What was an original homogeneous marble, like that of the Chino Hill, became converted into areas of localized mineral associations. Deep blue calcite in large cleavage rhombohedrons was crystallized and the intermixed associated minerals were found to be constantly varying. With the stupendous blasting and rapid clean-up of the quarry floor minerals observed one day would be gone the next, and some of them never seen again. My attention was directed to the deposit by the receipt of some specimens of sky-blue calcite associated with brownish monticellite and studded thickly with green brittle plates of xanthophyllite. The material was so abundant that it was used for road-metal and for sugar refining as well as for cement, with the consequence that it soon disappeared and nothing like it has been found since. A similar case of disappearance is the new mineral, foshagite. One large and several smaller boulders were observed containing this mineral in large masses, with the white granular thaumasite; yet two months later Mr. Foshag visited the quarry and not a vestige of these boulders nor of the mineral could be found. Mineral science has been enriched by the blasting operations of the cement company but at the same time it has lost material of incalculable value to science, through the speedy destruction of the rock without any super-

vision by some one versed in the value of minerals. No other metamorphic limestone deposit is known which presents such an intricate maze of new, rare, and unusual associations, all of specimen value.

At the present time the company has transferred its operations to another deposit a few miles west of Crestmore and the "Commercial" quarry has been abandoned. This does not mean that it lacks interest to the collector. Vesuvianite, garnet, wollastonite, gehlenite, sky-blue calcite, crestmoreite are some of the minerals still to be found in abundance, and there is always the joyful anticipation of finding new species while knocking about amongst the numerous boulders, discarded for cement.

Mineralogists visiting southern California should plan to stop at Riverside, and equipped with bag, hammer and lunch, should spend at least one day at the quarry. Specimens worth while can be collected and there is still much unrecognizable material to unravel. Danburite has not been reported from the quarry but Mr. Vonsen found it in his samples. The metallic sulphides are subordinate in amount yet some good specimens of them have been found.

For the convenience of those who might visit the quarry a complete list of the minerals so far observed at Crestmore is given below. Those which were new minerals when described have been starred.

Anglesite, apatite, apophyllite, aragonite, arsenopyrite, augite, axinite, azurite, biotite, bornite, brucite, calcite, cerussite, chalcocite, chalcopyrite, chondrodite, clinochlore, crestmoreite,* danburite, datolite, diopside, epidote, foshagite,* galenite, garnet, gehlenite, graphite, greenockite, hematite, hornblende, hydromagnesite, jurupaite,* kaolinite, labradorite, laumontite, limonite, malachite, merwinite,* monticellite, muscovite, okenite, opal, orthoclase, periclase, phlogopite, plazolite,* prehnite, pyrite, quartz, riversideite,* scapolite, serpentine, sphalerite, spurrite, tetrahedrite, thaumasite, titanite, tourmaline, tremolite, vesuvianite, wilkeite,* wollastonite, xanthophyllite and zircon.