SUMMARY

1. Colorless, very pale smoky, and dark smoky quartz specimens from Rincon, California, have been examined spectrographically.

2. The colorless, as well as the very pale smoky quartz samples were found to contain more lithium than the dark smoky quartz, regardless of whether or not the various colored types formed parts of the same crystal or crystalline mass.

3. No other significant difference in composition, as regards metallic constituents, was found. Aluminum, vanadium, titanium, calcium, magnesium, and, of course, silicon, were found to be present in all of the samples examined.

4. An improved spectrographic technique for examining minerals is described.

## TETRADYMITE FROM INYO MOUNTAINS, CALIFORNIA

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Samples of a brilliant, foliated metallic mineral collected in the Cerro Gordo district, Inyo mountains, Inyo County, California, proved upon examination to be tetradymite. The occurrence of this mineral has not been reported, as far as the writer is aware, in the suite of minerals of the Cerro Gordo district.[1]

In a hand specimen the tetradymite occurs as myriads of brilliant tabular crystals about 1/16 inch in diameter. It is imbedded in an earthy, powdery, apple to pale green mineral identified as bismutite. Other associated minerals are quartz, and a straw yellow powder that has not as yet been positively determined.

The physical properties of the tetradymite are: luster, metallic, brilliant; color, tin white to light silver gray; hardness 1.5–2; perfect basal cleavage. No specific gravity determinations were made.

Qualitative chemical analysis indicates (a) trace of sulphur upon roasting, (b) no selenium, (c) presence of tellurium upon solution with concentrated sulphuric acid, (d) presence of bismuth upon fusion with potassium iodide and sulphur.

A polished section of the ore, prepared and examined by Mr. V. C. Kelley, of the California Institute of Technology, showed the

[1] Knopf, A., A Geologic Reconnaissance of the Inyo Range, etc., *U. S. Geol. Surv.*, Prof. Paper **110**, pp. 108–16, 1918.

Eakle, A. S., Minerals of California, *Calif. State Min. Bur.*, Bull. **91**, 1923.

following minerals: (a) rutile, two or three grains; (b) quartz; (c) tetradymite; (d) chalcopyrite, one or two very small grains; (e) a black mineral occurring in minute specks in the tetradymite, not as yet positively identified, but may be tenorite; (f) bismutite. Paragenesis: rutile, quartz, tetradymite, chalcopyrite, tenorite (?), bismutite.

The specimens were found in a brecciated quartz vein about four inches wide, in an open cut prospect in the quartz monzonite of the Inyo Mountains.

Dana[2] mentions tetradymite from but six states, and none of these localities are in California. However, Eakle[3] lists two occurrences in California (reported by Hanks[4]), and one other unconfirmed occurrence.

[2] *Textbook of Mineralogy*, 4th edition, p. 412, **1932.**
[3] *Op. cit.*, p. 64, 1923.
[4] *4th Ann. Rept. State Mineralogist*, **1884.**

## ON THE APPLICATION OF DETERMINANTS TO CRYSTALLOGRAPHY

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*The American Mineralogist* published in its issue of December 1934 (vol. **19**, no. 12) a very interesting study by J. D. H. Donnay on "The theory of determinants applied to crystallography." It does not appear from the article whether the author considers the application of determinants to crystallography as something new or not; in any case the author does not mention anything to that effect.

I wish therefore to make it clear that priority, in this field, belongs to the Italian mineralogist Quintino Sella, who in the Notes A and B to his paper "Sul boro adamantino,"[1] submitted to the Academy of Sciences of Turin on the 14th of June 1857, and printed in 1858, showed that "the principal formulas of crystallography can be symbolically presented by means of the notations introduced by modern analysts in the calculus of determinants in a manner which is both concise and elegant."

The first problem treated by Sella, with the use of determinants,

[1] *Mem. R. Acc. delle Scienze di Torino*, Ser. 2, tomo **XVII,** Torino, 1858. Reprinted in "Memorie di cristallografia di Quintino Sella," *Mem. R. Acc. Lincei, Cl. di Sc. fis; mat, e nat.*, vol. **II,** Roma, 1885.