

With compounds these problems become much more complicated, that is, if we try to explain them in terms of atomic structure. Among organic compounds we find isomers and polymers, and many of them contain a hundred or more atoms to the molecule. How are their electrons rearranged, and what are they doing? All of these compounds, as I have already shown, are items in the general scheme of the evolution of matter, in which the question of atomic structure is fundamental. I have in this paper only touched the surface of a vast general problem, but my imagination has never wandered far from evidence and reasonable analogies. Perhaps I have made suggestions which may lead others to the discovery of new truths.

MINERALOGY.—*On galenobismutite from a gold-quartz vein in Boise County, Idaho.*¹ EARL V. SHANNON, Department of Geology, United States National Museum. (Communicated by E. T. Wherry).

The mineral galenobismutite, first described by Sjögren from the Ko Mine, Nordmark, Sweden² has not heretofore been definitely identified at any second locality. The material from Fahlun, Sweden, described by Atterberg³ contains more selenium than sulfur and is doubtless either a mixture or a variety of weibullite or platynite. It is listed as a distinct species by Hintze⁴ under the name "selenbleiwismuthglanz."⁴ Alaskaite, included by Dana under galenobismutite, is regarded by Hintze and also by Wherry and Foshag as a distinct species.⁵ The lead sulfo-bismuthite from the tungsten veins of Deer Park, Washington, analyzed by R. C. Wells and described by Bancroft⁶ as intermediate between galenobismutite and cosalite is quite probably distinct from either. It thus appears that galenobismutite, properly so-called, is an exceedingly rare mineral. For this reason it becomes of interest to note that this mineral occurs as a constituent of a gold ore from Idaho preserved in the United States National Museum.

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²H. SJÖGREN. *Geol. Foren. Forh.* 4: 109. 1878.

³ATTERBERG. *Geol. Foren. Forh.* 2: 76. 1874.

⁴C. HINTZE. *Handbuch der Mineralogie*, 1: 1012.

⁵E. T. WHERRY and W. F. FOSHAG. *A new classification of the sulfo-salt minerals.* This JOURNAL 11: 1-8. 1921.

⁶HOWLAND BANCROFT. *Notes on tungsten deposits near Deer Park, Washington.* U. S. Geol. Survey Bull. 430: 216. 1910.

The specimen was collected by Edward L. Jones, Jr., of the U. S. Geological Survey and is included in an unstudied collection of ores from southern Idaho. The label gives as the field number SI-106, and as the locality, Belzazzar Mine dump, Quartzburg district. The specimen was collected September 15, 1915. Regarding the Belzazzar Mine, Lindgren states that it is located on the Fall Creek side and has been opened by sluicing and a tunnel, 200 feet below the summit. Bodies of heavy sulfurets, chiefly pyrite, are exposed along the vein. The western part of the vein lies in hornblende porphyrite, while the eastern end has granite in the footwall and the same porphyrite in the hanging wall.⁷ Bell gives the location of the mine as near the Jerusalem Valley road, a little west of Quartzburg.⁸ He states that the ore is merely an altered phase of the enclosing rock traversed by quartz seams. The ore was free-milling on the first and second levels and produced fine specimens of free gold. The third level, however, showed considerable amounts of sulfides and only half of the gold in this sulfide ore was recoverable by amalgamation. The ore is said to average from \$8.00 to \$12.00 per ton.

The specimen which contains the galenobismutite consists in the main of translucent to transparent crystalline white vein quartz. The sequence of deposition of the minerals is not entirely clear but there is a band of more or less pure pyrite adjacent to the wall of the vein and this pyrite appears to be the earliest mineral of the ore. The quartz is slightly sheeted parallel to the vein wall, small grains of pyrite being distributed along the partings. Pyrite occurs also in crystalline grains through the quartz and also as sharply bounded cubic crystals in greatly sericitized fragments of wall rock which occur in the quartz. The quartz is loose textured and contains small angular cavities between the crystals. The galenobismutite occurs interstitially with relation to the quartz crystals and projects as fibrous bundles of prismatic needles into the cavities. It is clearly the youngest mineral of the vein, the common paragenetic position of the majority of the lead sulfo-salts.

The galenobismutite is rather light gray in color and tarnishes to a yellowish color. Its luster is rather more brilliant than that of the antimonial sulfo-salts of lead, and the mineral greatly resembles bismuthinite in general appearance. It forms elongated prisms im-

⁷WALDEMAR LINDGREN. *Mining Districts of the Idaho Basin and Boise Ridge, Idaho*. U. S. Geol. Survey, Ann. Rept. 18, Pt. III: 690. 1896-97.

⁸ROBERT N. BELL. Rept. Idaho State Inspector of Mines for 1905, p. 33.

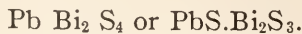
bedded in quartz or minute, deeply striated crystals in open cavities. The streak is black on porcelain or brownish black when rubbed very thin with a glass rod. The hardness is about 2.5.

Material for analysis was secured free from impurities other than quartz and a little pyrite, both of which remained unattacked when the mineral was dissolved in hydrochloric acid. The material was found to be free from other impurities by examination of polished surfaces under the microscope. Standard methods of analysis were used, the bismuth and lead being separated by the basic nitrate method. It is noteworthy, however, that this method, which is the one recommended by most textbooks, is one which gives satisfactory results only when performed with extreme care. The major separation was accomplished by precipitating the bismuth by means of hydrogen sulfide in strongly acid solution, the precipitate being almost free from lead while very little bismuth remained in solution. The separation by the basic nitrate method was repeated several times on each product of this separation before these two metals were obtained free from each other. The material available for analysis was too small to permit sulfur to be determined. The results of the analysis, recalculated after deducting gangue, are given in table 1.

TABLE 1.
ANALYSIS OF GALENOBISMUTITE FROM IDAHO

		Per cent	Calculation of Ratios		
Lead	Pb	23.93	0.1155	1434	1.03 × 1
Iron	Fe	.39	0.0057		
Copper	Cu	1.73	0.0272		
Antimony	Sb	2.56	0.0213	2789	1.00 × 2
Bismuth	Bi	53.59	0.2576		
Sulfur (calculated)	S	17.80	0.5550	5550	1.00 × 4
Total		100.00			

The formula thus derived is:



The copper, iron, and antimony, while present in minor amount, merit note. Copper and iron while probably not entirely isomorphous with lead, can perhaps enter into solid solutions in limited amount, the copper in all probability being in the cupric state. It is possibly significant that copper and iron are molecularly roughly equivalent to the antimony and may be combined with it. Such an amount of copper and iron compounds might conceivably be present as submicroscopic inclusions in the galenobismutite.