The Occurrence of Germanium in the Hot Springs of Senami.

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Germanium occurs in quite appreciable amounts in some mineral waters.[1] J. Bardet reported germanium to be present in the mineral waters of Vichy to the extent of one part in 40,000,000 parts of water. In this country, it was also found spectroscopically by Prof. K. Kimura in a large number of mineral waters [2] In the present work the author attempted a spectroscopic estimation of the element in the hot springs of Senami, Niigata Prefecture.

Arc Spectrographic Estimation of Germanium. J. Papish and his collaborators[3] described a method of the arc spectrographic estimation of germanium, in which the germanium solution was placed on the lower electrode. In the present paper the author describes a method in which germanium is added to sodium chloride in various concentrations. 0.1441 g. of pure germanium dioxide was dissolved in water and the volume was made up to 100 c.c. Each c.c. of this solution contains 1 mg. of germanium. From this stock solution, solutions containing 0.1, 0.01, 0.001, 0.0001 and 0.00001 mg. of germanium per c.c. were prepared. 10 mg. of sodium chloride was added to 1 c.c. of each solution, and evaporated to dryness. Then it was placed on the lower graphite electrode and subjected to arc excitation. The charges actcually placed on the lower electrodes contained 1, 0.1, 0.01, 0.001, 0.0001 and 0.00001 mg of germanium respectively. The Hilger spectrograph of E2 type was used. The spectral lines observed at different concentrations are described in Table 1. In this table, s signifies that the line in question is strong, w that it is weak and F that it is faintly visible.

Table 1.   Spectral Lines at Different Concentrations.

λ (Å)	1 mg	0.1 mg	0.01 mg	0.001 mg	0.0001 mg	0.00001 mg
2198.7	F					
2314.2	W					
2327.9	W					
2338.6	F					
2379.1	W					
2394.1	F					
2397.9	F	F				
2417.4	S	W	W	F		
2498.0	W					

(1)   J. Bardet, *Compt. rend.*, **157** (1913), 224; **158** (1914), 1278; A. P. Forjaz, *Compt. rend.*, **186** (1928), 1366; **189** (1929), 703.
(2)   Not yet published.
(3)   J. Papish, F. M. Brewer and D. A. Holt, *J. Am. Chem. Soc.*, **49** (1927), 3028.

Table 1.—(Concluded)

λ (Å)	1 mg	0.1 mg	0.01 mg	0.001 mg	0.0001 mg	0.00001 mg
2533.2	S	W				
2556.3	W					
2589.2	W	F				
2592.6	S	W	W	F		
2644.2	W	F				
2651.1	S	S	W	W	W	F
2651.6	S	S	W	W	F	
2691.3	S	S	W	W	F	
2709.6	S	S	W	W	F	
2740.4	S	F				
2754.6	S	S	W	W	F	
2793.9	W					
2829.1	W					
3039.1	S	S	W	W		
3067.1	W					
3124.8	W	W				
3269.5	S	W	F			

Germanium Content of the Hot Springs of Senami.[4]　500 c.c. of water sample was evaporated to complete dryness. Finely powdered residue in ten milligram portions was subjected to arc excitation. The following germanium lines were always found :—

λ (Å)	Intensity
2651.1	weak
2651.6	faint
2691.3	faint
2709.6	faint
2754.6	faint

This would seem to indicate that 0.0001 mg. of germanium was present in the zone of excitation. Expressed in percentages, the germanium content in the total residue is estimated to be 0.001. Expressed in terms of parts per million of the mineral water, it is supposed to be 0.03.

Summary.

A method for the arc spectrographic detection and estimation of germanium was described.

The germanium content of the hot springs of Senami was estimated.

(4) According to R. Ishizu, the spring is classified as common salt spring.