Isotopic Composition of the Common Lead in Japan

By Hitoshi Sakai, Masatake Honda and Eiichi Minami

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Fourteen lead samples, mainly consisting of galenas, from the various parts of Japan are analyzed for their isotopic compositions of lead. Using a commercial mass-spectrometer, Model 21-103A of Consolidated Engineering Co., the samples are analyzed in the form of lead tetra-methyl as described by Collins et al.[1] and Dibeler and Mohler[2]. Of four main peak groups in the mass-spectrogram of lead tetra-methyl, the first group consisting of Pb^+ and PbH^+ is used for the isotopic analysis. Since Pb^{204} peak is usually very small compared to those of other isotopes of lead, the superposition of Hg^{204} peak to that of Pb^{204} must be accurately corrected. For this purpose mercury dimethyl is synthesized from the same mercury as used in the pumping system of the instrument and the peak ratio of Hg^{204} to Hg^{202} is found to be 0.231 ± 0.001 for the same machine. This correction factor is used throughout the research.

The time variation of working conditions of the mass-spectrometer is checked by a standard sample and is proved to be negligibly small in the course of the experiment.

The results are summarized in Table I, and the maximum standard deviation is $\pm 0.5\%$ of the values.

A standard sample, galena, from Broken Hill, New South Wales, is analyzed by the same method and the values 16.07, 15.41 and 35.87 are obtained for the ratios Pb^{206}/Pb^{204}, Pb^{207}/Pb^{204} and Pb^{208}/Pb^{204}, respectively. They are in good agreement with Nier's data[3], 16.07, 15.40 and 35.5, respectively, for the corresponding ratio's obtained for a galena from the same district.

A number of lead ores of recent geologic ages from the various parts of the world has been analyzed by many researchers. For example, Tilton et al.[4] calculated the average composition of lead ores formed within the last 50 m.y. by least squares analysis of the data by Collins et al.[5]. They

TABLE I

ISOTOPIC COMPOSITION OF ORE LEAD IN JAPAN

No.	Locality	Mineral	Isotopic Composition of Lead $\frac{Pb^{206}}{Pb^{204}}$	$\frac{Pb^{207}}{Pb^{204}}$	$\frac{Pb^{208}}{Pb^{204}}$	Geologic Age
			(Atomic Ratio)			
1	Kamioka Mine, Gifu Prefecture	Galena	18.20±0.05	15.55±0.05	38.71±0.15	Cretaceous
2	Daira Mine, Akita Prefecture	Galena	18.32±0.05	15.43±0.05	38.45±0.15	Tertiary
3	Hanaoka Mine, Akita Prefecture	Galena	18.55±0.05	15.57±0.05	38.61±0.15	Tertiary
4	Arakawa Mine, Akita Prefecture	Galena	18.44±0.05	15.57±0.05	38.74±0.15	Tertiary
5	Hosokura Mine, Akita Prefecture	Galena	18.59±0.05	15.59±0.05	38.73±0.15	Tertiary
6	Tamagawa Hotsprings, Akita Prefecture	Hokutolite	18.63±0.05	15.61±0.05	39.04±0.15	—
7	Osaruzawa Mine, Akita Prefecture	Galena	18.54±0.05	15.58±0.05	38.82±0.15	Tertiary
8	Taishuu Mine, Nagasaki Prefecture	Galena	18.47±0.05	15.59±0.05	39.02±0.15	Cretaceous
9	Budō Mine, Niigata Prefecture	Galena	18.42±0.05	15.50±0.05	38.60±0.15	Tertiary
10	Mikawa Mine, Niigata Prefecture	Galeha	18.58±0.05	15.66±0.05	39.00±0.15	Tertiary Probably
11	Chichibu Mine, Saitama Prefecture	Galena	18.71±0.05	15.83±0.05	39.20±0.15	Tertiary
12	Ogoya Mine, Ishikawa Prefecture	Pyro-morphite	18.82±0.05	15.67±0.05	39.32±0.15	Tertiary
13	Sani-mura, Shioya, Ibaragi Prefecture	Galena	18.36±0.05	15.53±0.05	38.59±0.15	—
14	Tōya Mine Hokkaidō	Galena	18.52±0.05	15.56±0.05	38.68±0.15	Tertiary
	The average value of Galena sample:		18.48	15.59	38.76	

are 18.5, 15.6 and 38.4 for the ratios, Pb^{206}/Pb^{204}, Pb^{207}/Pb^{204} and Pb^{208}/Pb^{204}, respectively, and in good agreement with the average value of the recent lead from Japan. From Table I, however, it is seen that "secondary" lead ores, Hokutolite and Pyromorphite, as well as some of the galena have comparatively high content of thorium lead, of which the geological meanings are not yet known.

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Department of Chemistry, Faculty of Science, Tokyo University
Tokyo