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2 Italy

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4 **Running title:** Suseinargiuite, the Na-Bi analogue of wulfenite

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24 **Suseinargiuite, NaBi(MoO₄)₂, the Na-Bi analogue of**
25 **wulfenite, from Su Seinargiu, Sardinia, Italy**

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38

ABSTRACT

39

40 The new mineral species suseinargiuite, $\text{NaBi}(\text{MoO}_4)_2$, has been discovered in the Mo-Bi
 41 mineralization of Su Seinargiu, Sarroch, Cagliari, Sardinia, Italy. It occurs as hemispherical
 42 aggregates of very small acicular crystals, up to some μm in length. It is colorless, with a pearly to
 43 adamantine luster. In the studied specimens, suseinargiuite is associated with wulfenite. Micro-
 44 Raman spectra were collected in the region between 100 and 2000 cm^{-1} . The following bands have
 45 been observed (in cm^{-1}): 131, 188, 319, ~ 376 , ~ 772 , and 876. Electron microprobe data collected
 46 on a chemically-zoned grain gave (outer and inner zone, respectively – in wt%): MoO_3 49.03, Bi_2O_3
 47 42.97, PbO 2.89, Na_2O 3.69, sum 98.58, and MoO_3 45.59, Bi_2O_3 34.47, PbO 12.04, Na_2O 3.03, sum
 48 95.13. On the basis of 8 O atoms per formula unit, the outer and inner zones of the studied grain
 49 have chemical formulae $(\text{Na}_{0.69}\text{Bi}_{1.08}\text{Pb}_{0.08})_{\Sigma=1.85}\text{Mo}_{1.99}\text{O}_8$ and $(\text{Na}_{0.61}\text{Bi}_{0.93}\text{Pb}_{0.34})_{\Sigma=1.88}\text{Mo}_{1.99}\text{O}_8$,
 50 respectively. Main diffraction lines are [d in Å (relative visual intensity) hkl]: 3.146 (vs) 112, 2.912
 51 (mw) 004, 2.652 (mw) 200, 1.964 (m) 204, 1.728 (mw) 116, 1.875 (mw) 220, and 1.616 (mw) 312
 52 and 132. Unit-cell parameters, refined from the powder X-ray diffraction data in a tetragonal
 53 setting, space group $I4_1/a$, are $a = 5.296(1)$, $c = 11.673(2)$ Å, $V = 327.4(1)$ Å³, $Z = 2$. Owing to the
 54 lack of suitable crystals and the very small amount of available material, the crystal structure of
 55 suseinargiuite was not solved. However, X-ray powder diffraction data, micro-Raman spectra, as
 56 well as chemical analysis, show the close correspondence between suseinargiuite with synthetic
 57 $\text{NaBi}(\text{MoO}_4)_2$, which displays a scheelite-type structure.

58

59 *Key-words:* suseinargiuite, new mineral, sodium, bismuth, molybdate, scheelite-type structure, Su
 60 Seinargiu, Sardinia, Italy.

61

62 **1. Introduction**

63 In the last few years, the small Su Seinargiu prospect has provided the systematic
64 mineralogy with a significant number of molybdenum secondary minerals, represented by bismuth-
65 molybdenum oxides (sardignaite, gelosaite, and mambertiite; Orlandi *et al.*, 2010, 2011, and 2015b)
66 and molybdates (tancaite-(Ce), ichnusaite, and nuragheite; Orlandi & Bonaccorsi, 2010; Orlandi *et*
67 *al.*, 2014 and 2015a). It is noteworthy that, among the 12 valid mineral species characterized by the
68 oxoanion $(\text{MoO}_4)^{2-}$, three (*i.e.* one quarter) have their type locality at Su Seinargiu that consequently
69 represent a reference locality for the study of these minerals.

70 During the routine check of specimens from this Sardinian locality through qualitative EDS
71 chemical analysis, two samples, provided to us by the mineral collector Fernando Caboni, were
72 found to contain Na, Bi, Mo, and minor Pb as the only elements with $Z > 9$. X-ray powder
73 diffraction patterns collected on a very small grain by using a Gandolfi camera indicated the
74 identity between this unknown mineral and the synthetic compound $\text{NaBi}(\text{MoO}_4)_2$, having a
75 scheelite-type structure (Teller, 1992; Hanuza *et al.*, 1997; Wařkowska *et al.*, 2005) and actively
76 studied for its optical and luminescent properties (*e.g.*, Mazurak *et al.*, 1987; Rico *et al.*, 2002;
77 Volkov *et al.*, 2002). Owing to the lack of suitable crystals for single-crystal X-ray diffraction and
78 the very small amount of available material that did not allow a Rietveld refinement, a micro-
79 Raman spectrum was also collected, in order to confirm the identity with its synthetic analogue.
80 Additionally, other grains have chemistry and X-ray powder diffraction patterns intermediate
81 between those of the new compound and wulfenite, $\text{Pb}(\text{MoO}_4)$, suggesting the possible existence of
82 a solid solution between $\text{NaBi}(\text{MoO}_4)_2$ [or better $\text{Na}_{0.5}\text{Bi}_{0.5}(\text{MoO}_4)$] and $\text{Pb}(\text{MoO}_4)$.

83 The new mineral species was named suseinargiuite, from its type locality, Punta de Su
84 Seinargiu (or more simply Su Seinargiu), Sarroch, Cagliari, Sardinia, Italy. The mineral and its
85 name have been approved by the IMA CNMNC (IMA 2014-089). The holotype specimen of
86 suseinargiuite is deposited in the mineralogical collection of the Museo di Storia Naturale,
87 Università di Pisa, via Roma 79, Calci (PI), Italy, with catalogue number 19692.

88 This paper presents the definition of suseinargiuite, describing its occurrence and its
89 relationships with wulfenite and synthetic $\text{NaBi}(\text{MoO}_4)_2$.

90 **2. Occurrence and mineral description**

91 The Su Seinargiu prospect is located on the southern coast of Sardinia, northwest of the
92 town of Sarroch. The Mo-Bi mineralization occurs as vein systems embedded in leucogranite
93 porphyry, hosted within shales of Ordovician-Silurian age metamorphosed up to the greenschist

94 facies. The vein mineralogy is very simple, being composed by quartz and molybdenite, with minor
95 amounts of other sulfides (chalcopyrite, galena, sphalerite, and bismuthinite) and rare native
96 bismuth (Orlandi *et al.*, 2013). A pervasive hydrothermal alteration is common throughout the
97 magmatic rocks, resulting in the appearance of clay minerals replacing plagioclase and K-feldspar.

98 Molybdenite is also frequently altered in secondary minerals, initially indicated as
99 “molybdenite” by Caboi *et al.* (1978). The recent mineralogical studies carried out by Orlandi *et al.*
100 (2013) showed actually the occurrence of a wide series of minerals formed by hydrothermal and/or
101 supergenic alteration of the primary Mo-Bi mineral assemblage.

102 Suseinargiuite occurs as hemispherical aggregates (up to 0.2-0.3 mm in diameter) of very
103 small acicular crystals, up to few μm in length. Crystals are colorless, transparent, with a pearly to
104 adamantine luster. The mineral is brittle. Owing to the very small crystal size, micro-hardness was
105 not measured. Density was not measured owing to the very low amount of available material;
106 calculated density, based on the ideal formula, is 5.604 g/cm^3 . In plane-polarized transmitted light,
107 suseinargiuite is transparent, colorless, with a high relief. With crossed polars, extinction is parallel
108 and birefringence is high. The mean refractive index is 2.11 according to the Gladstone-Dale
109 relationship (Mandarino, 1979, 1981) using the ideal formula and the calculated density.

110 In the studied specimens, suseinargiuite is associated with wulfenite in small vugs of quartz
111 veins.

112

113 2.1. Chemical data

114 Preliminary qualitative chemical analyses were performed using a Philips XL30 scanning
115 electron microscope equipped with an EDAX DX4 system. The only elements with $Z > 9$ detected
116 in suseinargiuite are Na, Bi, Mo, and minor Pb. Quantitative chemical analyses were carried out
117 with a Cameca SX100 electron-microprobe (WDS mode) using the following analytical conditions:
118 accelerating voltage 20 kV, beam current 15 nA, beam size 1 μm . Standards (element, emission
119 line) are: albite (Na $K\alpha$), metallic Mo (Mo $L\alpha$), metallic Bi (Bi $M\alpha$), and galena (Pb $M\alpha$). Tungsten
120 was sought but was not detected. The studied grain resulted being chemically zoned (Fig. 1), with
121 an outer zone enriched in Na and Bi and a Pb-enriched core. Analytical data for the outer and inner
122 zones are given in Table 1. Low analytical totals are related to the porous micro-crystalline texture
123 of the sample, in particular for the inner zone, where the small size of intergrown crystals precluded
124 spot analysis on a pore-free area.

125 The empirical formulae, based on 8 oxygen atoms per formula unit (apfu), are
126 $(\text{Na}_{0.69(6)}\text{Bi}_{1.08(3)}\text{Pb}_{0.08(3)})_{\Sigma=1.85(2)}\text{Mo}_{1.99(1)}\text{O}_8$ and $(\text{Na}_{0.61(4)}\text{Bi}_{0.93(2)}\text{Pb}_{0.34(4)})_{\Sigma=1.99(1)}\text{O}_8$ for the outer and
127 inner zones, respectively.

128 Without taking into account the Na deficit relatively to Bi (see § 3), the ideal formula of
129 suseinargiuite is $\text{NaBi}(\text{MoO}_4)_2$, corresponding to (in wt%) MoO_3 52.17, Bi_2O_3 42.22, Na_2O 5.62,
130 sum 100.00.

131

132 2.2. Crystallography

133 X-ray powder diffraction pattern of suseinargiuite was collected using a 114.6 mm Gandolfi
134 camera with Ni-filtered Cu $K\alpha$ radiation and is given in Table 2. Figure 2 shows the X-ray powder
135 diffraction pattern compared with those calculated on the basis of the structural model of synthetic
136 $\text{NaBi}(\text{MoO}_4)_2$ using the atomic coordinates and displacement parameters given by Wařkowska *et*
137 *al.* (2005). The shift towards lower 2θ values is due to Pb incorporation (see below).

138 Unit-cell parameters of suseinargiuite, refined from the powder data using the method of
139 Holland & Redfern (1997) on the basis of 10 unequivocally indexed reflections, are as follows: $a =$
140 $5.296(1)$, $c = 11.673(2)$ Å, $V = 327.4(1)$ Å³, $Z = 2$, space group $I4_1/a$. The $c:a$ ratio calculated from
141 the unit-cell parameters is 2.204.

142

143 2.3. Micro-Raman Spectroscopy

144 Raman analyses were carried out employing a confocal Raman microprobe (Horiba Jobin-
145 Yvon T64000) coupled with an optical microscope and equipped with an Ar⁺ laser source ($\lambda_0 =$
146 514.5 nm), a double subtractive stage plus spectrograph and diffraction gratings of 1800 gr/mm, and
147 a liquid-nitrogen cooled CCD detector Symphony (1024 × 256 pixels). Raman spectra were
148 collected on the same grain used for electron-microprobe analysis. Spectra were collected in the
149 region between 100 and 2000 cm^{-1} , with a slit and hole aperture of 100 μm , laser beam power on
150 the sample of 1.5 mW, and an integration time of 10 s, for 2 accumulation cycles. The diameter of
151 the laser spot on the sample surface was ~ 2 μm for the fully focused laser beam at 50× objective
152 magnification. The spectral resolution was 1 cm^{-1} and the instrument was calibrated against the
153 Stokes Raman signal of pure Si at 520 cm^{-1} using a silicon wafer. Instrument control and data
154 acquisition, as well as the processing of Raman spectra, were performed with the software LabSpec
155 5 (Horiba Jobin-Yvon).

156 The Raman spectrum in the range 100 – 2000 cm^{-1} is shown in Figure 3 together with the
157 position of the main bands. The spectrum of suseinargiuite compares very well with those reported
158 by Hanuza *et al.* (1997) for synthetic $\text{NaBi}(\text{MoO}_4)_2$. The observed bands correspond to vibrational
159 modes of (MoO_4) groups. The following bands have been observed (in cm^{-1} ; within parentheses the
160 wavenumber given by Hanuza *et al.*, 1997): 131 (130), 188 (192), 319 (322), ~ 376 (377), ~ 772
161 (768), and 876 (876).

162 3. Crystal-chemistry of suseinargiuite

163 Owing to the lack of suitable crystals, the crystal structure of suseinargiuite was not solved.
164 However, the mineral is the analogue of synthetic $\text{NaBi}(\text{MoO}_4)_2$ whose crystal structure has been
165 reported by several authors (*e.g.*, Teller, 1992; Hanuza *et al.*, 1995; Wařkowska *et al.*, 2005).

166 Suseinargiuite has a scheelite-type structure (Fig. 4), commonly adopted by ABO_4
167 compositions. In these compounds, A^+ and A^{3+} ions are randomly distributed at the eight-fold
168 coordinated Ca site (using the site notation of the scheelite structure), whereas Mo is tetrahedrally
169 coordinated at the W site. According to Teller (1992), $\text{Na}_{0.5}\text{Bi}_{0.5}\text{MoO}_4$ and $\text{Na}_{0.32}\text{Bi}_{0.56}\square_{0.18}\text{MoO}_4$
170 adopt the $I4_1/a$ scheelite structure, whereas Hanuza *et al.* (1997) proposed a slightly distorted
171 scheelite structure with space group $I\bar{4}$. Finally, Wařkowska *et al.* (2005) assumed the $I4_1/a$ space
172 group as the correct one for $\text{NaBi}(\text{MoO}_4)_2$.

173 As stated above, suseinargiuite has been observed in association with wulfenite. Qualitative
174 chemical data and X-ray powder diffraction patterns suggest a solid solution between suseinargiuite
175 and wulfenite through the substitution mechanism $\text{Na}^+ + \text{Bi}^{3+} = 2\text{Pb}^{2+}$. Chemical analyses showed
176 different (Na+Bi)/Pb ratios, whereas the X-ray powder diffraction patterns collected on samples
177 from Su Seinargiu showed a shift in the peak positions, *e.g.*, the d_{112} spacing moves from 3.146 Å in
178 suseinargiuite to 3.24 Å in wulfenite. This is in accordance with the increase of unit-cell parameters
179 from Pb-free synthetic suseinargiuite up to wulfenite (Table 3). Particularly, suseinargiuite has an
180 unit-cell volume (327.4 Å³) between those of its stoichiometric Pb-free pole and of wulfenite (~ 322
181 and 357.5 Å³, respectively).

182 Moreover, it is noteworthy that chemical data show a constant deficit of Na relatively to Bi.
183 Previous authors (*e.g.*, Sleight *et al.*, 1975; Teller, 1992) observed the occurrence of vacancies in
184 synthetic $\text{NaBi}(\text{MoO}_4)_2$. Consequently, assuming that no Na volatilization occurs during the
185 electron-microprobe analysis, two possible substitution mechanisms could be invoked to explain the
186 observed chemistry of suseinargiuite:

187 i) $\text{Na}^+ + \text{Bi}^{3+} = 2\text{Pb}^{2+}$, with a strong increase of the unit-cell volume (Table 3);

188 ii) $3\text{Na}^+ = \text{Bi}^{3+} + 2\square$.

189 According to Teller (1992), this second substitution also increases the unit-cell volume,
190 principally by an increase of the c parameter (Table 3).

191 Consequently, the formula of suseinargiuite could correspond to $\text{Na}_{1-x-y}\text{Bi}_{1+x/3-}$
192 $y\square_{2x/3}\text{Pb}_{2y}(\text{MoO}_4)_2$ ($Z = 2$). The outer and the inner zones of the analyzed grains correspond to $x \sim$
193 0.27 , $y \sim 0.04$ and $x \sim 0.22$, $y \sim 0.17$.

194 **4. Conclusion**

195 Suseinargiuite is the Na-Bi analogue of wulfenite and fits the 07.GA group of Strunz and
196 Nickel (2001) classification, *i.e.* molybdates without additional anions or H₂O. The qualitative
197 chemical data suggest the possible existence of a wide solid solution between suseinargiuite and
198 wulfenite; unfortunately, owing to the extremely low amount of available material, data are still
199 incomplete and further studies are mandatory to accurately describe the chemical variability in the
200 series Na_{0.5}Bi_{0.5}(MoO₄) – Pb(MoO₄).

201 Suseinargiuite is the seventh new mineral species containing Mo found at Su Seinargiu that
202 consequently confirms its role as a world-class locality for the study of secondary molybdenum
203 minerals.

205 **Acknowledgments**

206 We are grateful to the mineral collector Fernando Caboni for providing us with the first
207 specimens of suseinargiuite.

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263

264 **Table captions**

265 **Table 1** – Electron-microprobe analyses of suseinarguite.

266 **Table 2** – X-ray powder diffraction data for suseinarguite. Calculated intensity and d_{hkl} were
267 obtained using the software Powdercell 2.3 (Kraus & Nolze, 1996) on the basis of the structural
268 model reported by Waśkowska *et al.*, 2005. The five strongest reflections are given in bold. The
269 asterisk * indicates the reflections used for the refinement of the unit-cell parameters. Observed
270 intensities were visually estimated (vs = very strong; m = medium; mw = medium-weak; w = weak;
271 vw = very weak). Only calculated reflections with $I_{calc} \geq 1$ are reported.

272 **Table 3** – Comparison of unit-cell parameters of suseinarguite with synthetics and natural
273 wulfenite.

274

275

276 **Figure captions**

277 **Figure 1** – Back-scattered electron image of an aggregate of acicular crystals of suseinarguite. The
278 outer zone (light grey) is depleted in Pb with respect to the inner zone (dark grey).

279 **Figure 2** – Comparison between observed (in black) and calculated (in red – based on the atomic
280 coordinates and displacement parameters given by Waśkowska *et al.*, 2005) X-ray powder
281 diffraction pattern for suseinarguite.

282 **Figure 3** – Micro-Raman spectrum of suseinarguite.

283 **Figure 4** – Crystal structure of synthetic $\text{NaBi}(\text{MoO}_4)_2$ (data after Waśkowska *et al.*, 2005).
284 Yellow: (Na,Bi)-centered polyhedra; red: Mo-centered tetrahedra.

285

286 **Table 1** – Electron-microprobe analyses of suseinargiuite.

Oxide	Outer zone (n = 12)			Inner zone (n = 14)		
	wt%	range	e.s.d.	wt%	range	e.s.d.
MoO ₃	49.03	47.54 – 51.14	1.11	45.59	43.49 – 48.01	1.25
Bi ₂ O ₃	42.97	41.55 – 44.14	0.95	34.47	32.77 – 37.49	1.21
PbO	2.89	1.36 – 4.87	1.10	12.04	8.81 – 13.82	1.34
Na ₂ O	3.69	3.28 – 4.39	0.39	3.03	2.76 – 3.40	0.20
Total	98.57	96.92 – 100.47	1.00	95.13	93.20 – 97.71	1.38
apfu (O = 8 apfu)						
Mo	1.987	1.975 – 1.998	0.008	1.987	1.960 – 1.998	0.011
Bi	1.077	1.044 – 1.117	0.026	0.928	0.896 – 0.963	0.015
Pb	0.076	0.034 – 0.131	0.030	0.339	0.236 – 0.395	0.044
Na	0.693	0.630 – 0.797	0.060	0.614	0.568 – 0.686	0.037
Na+Pb+Bi	1.845	1.819 – 1.887	0.024	1.881	1.835 – 1.996	0.043

287

288 **Table 2** – X-ray powder diffraction data for suseinarguite. Calculated intensity and d_{hkl} were
 289 obtained using the software Powdercell 2.3 (Kraus & Nolze, 1996) on the basis of the structural
 290 model reported by Waškowska *et al.*, 2005. The five strongest reflections are given in bold. The
 291 asterisk * indicates the reflections used for the refinement of the unit-cell parameters. Observed
 292 intensities were visually estimated (vs = very strong; m = medium; mw = medium-weak; w = weak;
 293 vw = very weak). Only calculated reflections with $I_{\text{calc}} \geq 1$ are reported.

I_{obs}	d_{obs}	I_{calc}	d_{calc}	hkl
vs	3.146*	100	3.135	1 1 2
mw	2.912*	14	2.894	0 0 4
mw	2.652*	19	2.637	2 0 0
vw	2.313*	2	2.311	2 1 1
		2	2.287	1 1 4
vw	2.135*	1	2.120	1 0 5
vw	2.014*	1	2.013	1 2 3
m	1.964*	28	1.949	2 0 4
mw	1.875*	12	1.865	2 2 0
mw	1.728*	15	1.714	1 1 6
mw	1.616	10, 13	1.603	3 1 2, 1 3 2
w	1.580*	10	1.568	2 2 4

294

295

296 **Table 3** – Comparison of unit-cell parameters of suseinargiuite with synthetics and natural
 297 wulfenite.

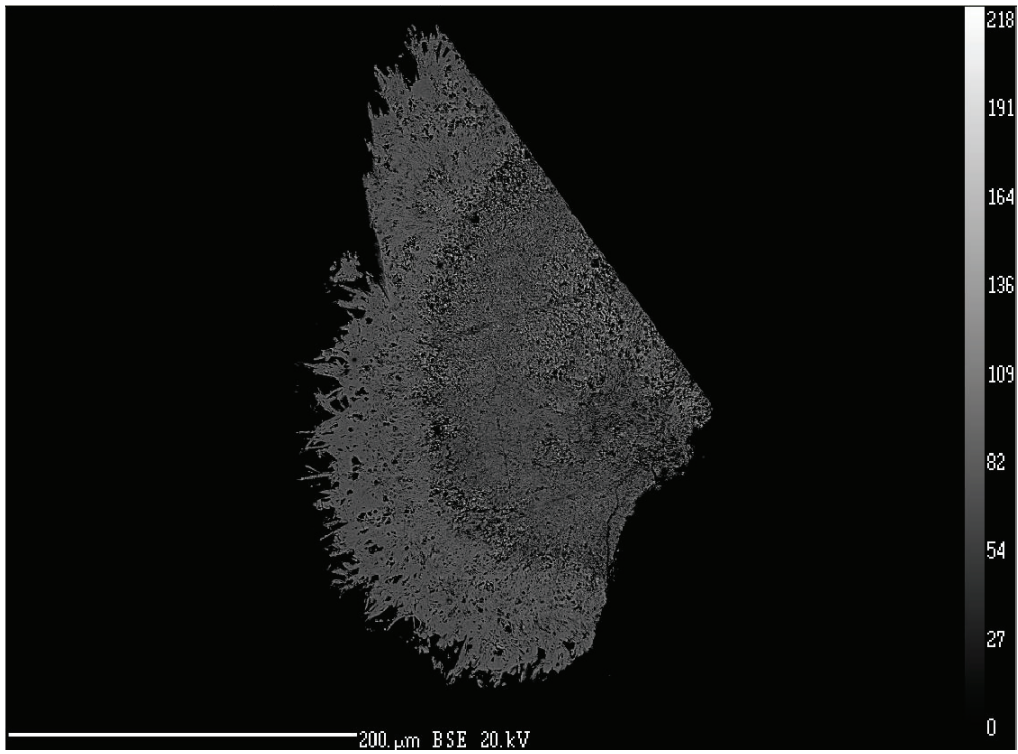
Compound	<i>a</i> (Å)	<i>c</i> (Å)	<i>V</i> (Å ³)	<i>c/a</i>	(Bi/Na) _{at.}
suseinargiuite	5.296	11.673	327.4	2.2041	variable
Teller (1992) S	5.271	11.5801	321.82	2.1967	0.5/0.5
Teller (1992) NS	5.2785	11.6410	324.35	2.2054	0.56/0.32
Hanuza <i>et al.</i> (1997)	5.267	11.565	320.83	2.1957	0.5/0.5
Waśkowska <i>et al.</i> (2005)	5.2744	11.578	322.09	2.1951	0.5/0.5
Wulfenite – Lugli <i>et al.</i> (1999)	5.434	12.107	357.5	2.2280	

Note: S: stoichiometric; NS = non-stoichiometric

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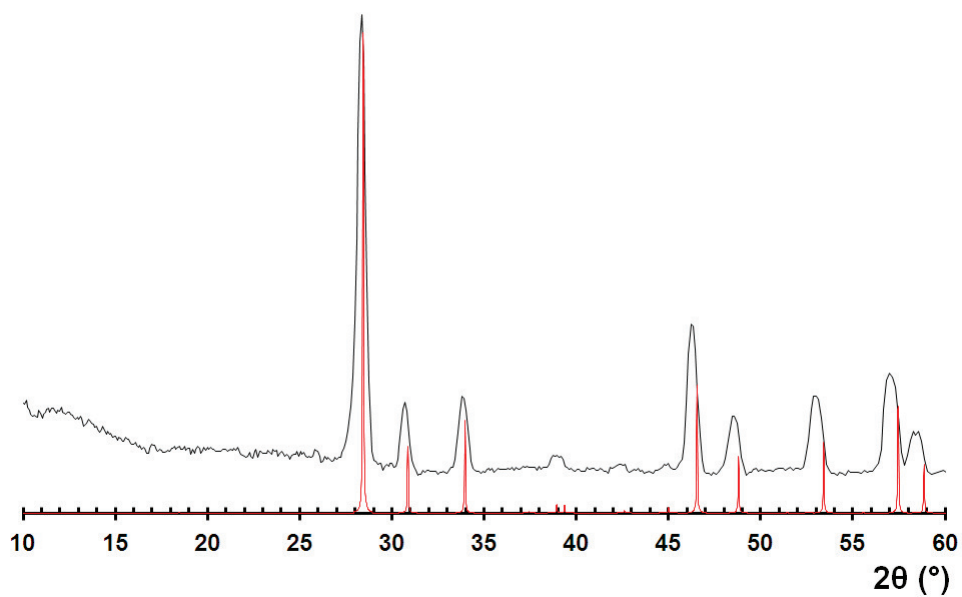
300 **Figure 1** – Back-scattered electron image of an aggregate of acicular crystals of suseinargiuite. The
301 outer zone (light grey) is depleted in Pb with respect to the inner zone (dark grey).



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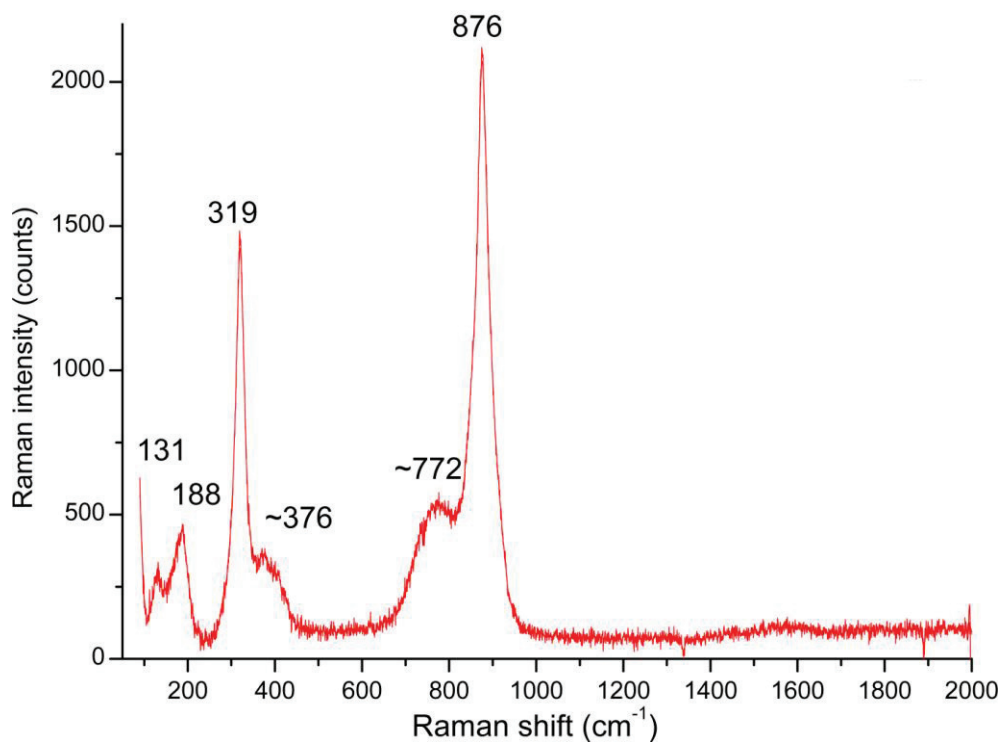
304 **Figure 2** – Comparison between observed (in black) and calculated (in red – based on the atomic
305 coordinates and displacement parameters given by Waśkowska *et al.*, 2005) X-ray powder
306 diffraction pattern for suseinargiuite.



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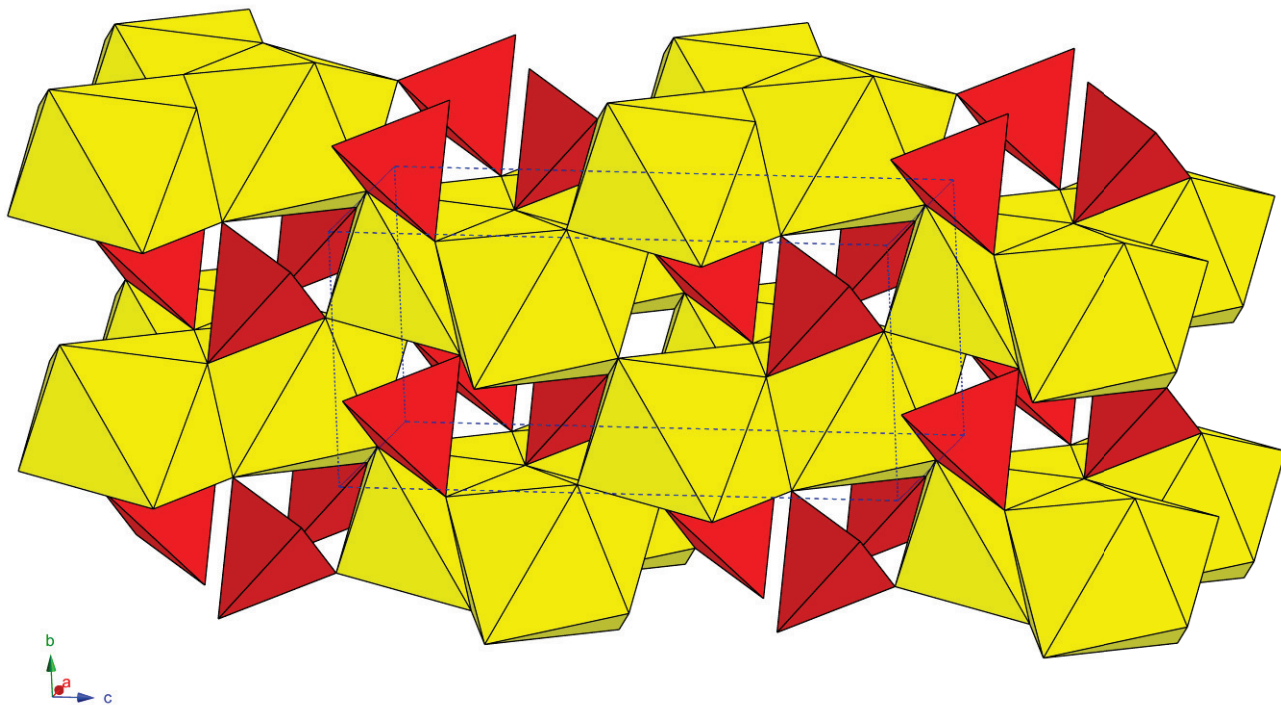
309 **Figure 3** – Micro-Raman spectrum of suseinargiuite.



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312 **Figure 4** – Crystal structure of synthetic $\text{NaBi}(\text{MoO}_4)_2$ (data after Waśkowska *et al.*, 2005).
313 Yellow: (Na,Bi)-centered polyhedra; red: Mo-centered tetrahedra.



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**INTERNATIONAL MINERALOGICAL ASSOCIATION
COMMISSION ON NEW MINERALS, NOMENCLATURE
AND CLASSIFICATION**

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6 March, 2015

Dear Dr. Orlandi,

Congratulations on your new mineral, SUSEINARGIUIITE (2014-089)!

The attached summary will appear in my next memorandum to the members of the Commission on New Minerals, Nomenclature and Classification. You should consider the comments of the members when you write your final description.

Although the Commission has no strict rule dealing with publication, I would ask that you ensure that the first published record of your mineral is in the scientific literature.

The CNMNC has decided to announce new minerals (**with or without their name, depending upon the authors' wishes**) with some data on the CNMNC website, one month after their approval. The text that will appear is attached below.

One of the rules of our Commission is that the description of a new mineral must be published within **two years** of notification of the approval. If publication does not take place during that time, approval of the mineral and its name will be withdrawn.

Proof of receipt of the type specimen(s) by the curator of the collection in which the type specimen(s) have been deposited must be sent to me as soon as possible to ensure approval.

The Commission strongly disapproves of the practice of providing specimens of new species to mineral dealers prior to the full description of the new species being published in the scientific literature.

Please send a copy of this letter with the manuscript of your description when you submit the paper for publication. This will indicate to the editor of the journal that the mineral and its name have been approved by the Commission on New Minerals, Nomenclature and Classification of the International Mineralogical Association.

Please send a reprint of the description to me when it is published.

Best regards,



Ulf Hålenius, Chairman CNMNC

Encl.

**Monthly announcement of new minerals on the CNMNC website and in the
Mineralogical Magazine
with or without their name, with a limited number of data.**

The Commission on New Minerals, Nomenclature and Classification decided in January 2010 (Proposal 09-D: the early publication of new mineral names) that additional data would be published one month after the approval date on the CNMNC website, and in the *Mineralogical Magazine*, under the heading of a CNMNC Newsletter.

For your newly approved mineral, the following data will be published in line with the above, unless you wish the mineral name to remain confidential until the full description is published. If this is the case, the name will be removed from the data listed below. **NOTIFY ME BY E-MAIL IF YOU DO NOT WISH TO HAVE THE NAME OF YOUR MINERAL RELEASED PRIOR TO PUBLICATION.**

IMA No. **2014-089**

Suseinargiuite

NaBi(MoO₄)₂

Su Seinargiu, Sarroch, Cagliari, Sardinia, Italy

Paolo Orlandi*, Cristian Biagioni, Yves Moëlo, Jessica Langlade and Eric Faulques

E-mail: paolorlandi.pisa@gmail.com

Na-Bi analogue of wulfenite

Tetragonal: $I4_1/a$

$a = 5.296(1)$, $c = 11.673(2)$ Å

3.146(vs), 2.912(mw), 2.652(mw), 1.964(m), 1.875(mw), 1.728(mw), 1.616(mw), 1.580(w)

Holotype material is deposited in the mineralogical collections of the Museo di Storia Naturale, Università di Pisa, Calci (Pisa), Italy, catalogue number 19692

How to cite: Orlandi, P., Biagioni, C., Moëlo, Y., Langlade, J. and Faulques, E. (2015)

Suseinargiuite, IMA 2014-089. CNMNC Newsletter No. X, Month 2015, page X;

Mineralogical Magazine, **XX**, XXX-XXX.