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Author(s)	OGASAHARA, Hiroshi; JIGE, Mayumi; YAMASHITA, Yoshiko; OHKAWA, Makio; KITAGAWA, Ryuji; NAKASHIMA, Akio; TAKENO, Setsuo
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Spherulitic Textures Found in Pyrophyllite Ore Deposits, Shobara District, Southwest Japan
—Photograph Collection—

By

Hiroshi OGASAHARA, Mayumi JIGE, Yoshiko YAMASHITA, Makio OHKAWA, Ryuji KITAGAWA, Akio NAKASHIMA and Setsuo TAKENO

with 33 figures
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Abstract: Spherulitic textures are commonly found in pyrophyllite ore deposits in Shobara district, Hiroshima Prefecture, Japan. Color photographs of the mode of occurrence, hand specimens and characteristic micro-textures are presented. The spherulitic textures occur mainly in the upper most horizon of the ore deposits, i.e., in pyrophyllite zone and weakly altered host rhyolitic rocks.

The size of the spherulites is from few millimeters to several centimeters in diameter and the spherulites with several millimeters diameter is the most predominant. Color of the spherulites is also variable such as grey, dark blue, dark purple and greenish color.

Under the microscope, the textures can be divided into two types, one is "radiation" and the other is "aggregation" types, respectively. The aggregation type is further subdivided into a) with fine grain rim and b) with coarse grain rim. The constituent minerals of the spherulite are feldspar, quartz, pyrophyllite, sericite, diaspore, hematite and goethite.

Introductory Remarks

Spherulitic textures often occur in nature such as in acidic volcanic rocks and in lunar samples(Lofgren, 1971). The texture is also produced experimentary, especially in the field of high polymers(e.g., Keith & Padden, Jr., 1963). Concerning the formation mechanism of the texture, numerous studies have been published up to the present(e.g., Keith & Padden Jr, 1963, 1964 a, b). Despite such widespread occurrence, detailed mechanism of spherulitic crystallization is remained to be solved.

In the Chugoku district, southwest Japan, numerous pyrophyllite ore deposits are developed especially in the areas of Shobara in Hiroshima and Mitsuishi in Okayama Prefectures, respectively. These deposits are occurred in the late Cretaceous volcanic rocks consisted mainly of rhyolitic, dacitic and andesitic rocks. In Shobara district, zonal arrangement of the altered rocks is generally established (Kinosaki, 1963). That is, from the lower to the upper horizon, weakly altered andesite, altered andesitic and dacitic tuff, silicified zone, kaolinite zone, pyrophyllite and corundum rich zone, kaolinite zone, zone of hematite and/or pyrite dissemination, silicified zone and finally altered rhyolitic zone. The spherulitic textures are commonly found above the pyrophyllite zone (Matsumoto, 1968). In the Shobara district, the spherulitic texture occurs associated intimately with Liesegang texture (Yamashita et al., 1996).

In this paper various spherulitic textures found in the Shobara district are presented. Size of the spherulitic texture is various in the range between few millimeters and several centimeters in diameter, and the size with several millimeters diameter is the most predominant. The color of the spherulites is also variable such as grey, dark purple, dark blue and greenish color.

Under the microscope, the textures can be classified into two types, one is "radiation" type and the other is "aggregation" type. The aggregation type is further subdivided into a) with coarse grain rim and b) with fine grain rim. The aggregation type is mainly occurred in the pyrophyllite zone whereas the radiation type is in the more upper horizon. All of these spherulites are composed of feldspar, quartz, pyrophyllite, sericite, diaspore and hematite.

References

Lofgren, G., 1971: Spherulitic textures in glassy and crystalline rocks, J. Geophys. Research, 76, No.23, 5635-5648.

Keith, H. D., and F. J. Padden, Jr., 1963: A phenomenological theory of spherulitic crystallization, J. Appl. Phys., 34, 2409-2421.

Keith, H. D., and F. J. Padden, Jr., 1964a: Spherulitic crystallization from the Melt, Ⅰ, fractionation and impurity segregation and their influence on crystalline morphology, J. Appl. Phys., 35, 1270-1285.

Keith, H. D., and F. J. Padden, Jr., 1964b: Spherulitic crystallization from the melt, Ⅱ, Influence of fractionation and impurity segregation on the kinetics of crystallization, J. Appl. Phys., 35, 1286-1296.

Kinosaki, Y., 1963: The pyrophyllite deposits in the Chugoku province, west Japan, Geol. Rep. Hiroshima Univ., 12, 1-35.(in Japanese with English abstract)

Matsumoto, K., 1968: On the Geology and pyrophyllite deposits of the Yano Shokozan mine, Hiroshima Prefecture, Geol. Rep. Hiroshima Univ., 16, 1-25.(in Japanese with English abstract)

Yamashita, Y., Ohkawa, M., Kitagawa, R. and Takeno, S., 1996: Liesegang texture found in pyrophyllite ore deposits, Shobara district, southwest Japan, J. Sci. Hiroshima Univ., Ser. C, 10, No.4, 583-591

Explanation of Figures

Fig.1: Outcrop of Sankin Motoyama ore deposit. Note that bedding plane (flow plane) of the host volcanic rock is clearly recognizable(from upper left to lower right in the figure). Spherulites are commonly occurred in the rocks shown in the figure.

Fig.2: Altered host rhyolitic rocks exhibiting Liesegang texture in the Sankin Motoyama outcrop. Spherulites with about 2mm diameter are occurred both in the deep color(blue) and the light color(with to grey) parts.

Fig.3: The rock is composed mostly of spherulites with relatively large (more than a centimeter) diameter.

Radiation Type

Fig.4: Hand specimen showing radiation type spherulite. A: with white core

and purplish rim, B: relatively small spherulites with less than 2mm in diameter and the color is homogeneously dark blue.

Fig.5: Typical radiation type spherulite. The radial fibrous crystals are feldspar. A is relatively small spherulite and B is larger one. (crossed nicols)

Fig.6: Marginal part of spherulite shown in Fig.5(A). Fibrous crystals of feldspar(A) are zonally arranged intercalated amorphous matrix. (plane polarized light)

Fig.7: B part of Fig.5. The spherulitic texture is composed of very fine fibrous crystals. The arrow indicates crystallites. (plane polarized light)

Fig.8: Hand specimen showing two different radiation type(A and B). Spherulites with less than about 1mm(A) in diameter are homogeneous with whitish color whereas those more than about 2mm have greyish core(B).

Fig.9: Radiation type with fine grained core and fibrous rim. In the A part, crystals are arranged concordantly with the spherulitic circle and B part is composed of fine quartz crystals. (plane polarized light)

Fig.10: Radiation type. The central part is composed of fibrous feldspar(A) whereas the rim is composed of relatively large grained quartz. (crossed nicols)

Fig.11: Detailed texture of the rim shown in Fig.10. Note that most of quartz crystals(A) show the same optical orientation. (crossed nicols)

Fig.12: Hands pecimen showing radiation type spherulites. Note that coalescence of two or three spherulites are observed in some parts. Cavities are also recognized (black in the figure).

Fig.13: Radiation type spherulite whose rim is composed of opaque minerals (black parts). Such spherulites in appearance looked whitish core and bluish rim. (plane polarized light)

Fig.14: Ditto showing that the central part is composed of quartz grains in fine grained sericite matrix. (crossed nicols)

Fig.15: Ditto showing the rim composed of randomly oriented quartz crystals. (crossed nicols)

Aggregation Type

Fig.16: Hand specimen showing aggregation type spherulites developed in the Liesegang rocks. Spherulites are occurred both in the deep color(blue) and light color(white to grey) parts. Most of the spherulites are greyish color with several mm diameter.

Fig.17: Aggregation type with coarse grain rim. The rim of the spherulite is composed of relatively large quartz crystals(A) and the quartz exhibits undulatory extinction. The core part is in many cases composed of fine grained pyrophyllite(B). Aggregation composed of fine opaque crystals is also recognized(C). (crossed nicols)

Fig.18: Ditto. Quartz grain showing undulatory extinction(A) and fine grained pyrophyllite(B). (crossed nicols)

Figs.19 and 20: Spherulites composed mostly of quartz crystals. The core is composed of relatively large crystals whereas the rim smaller. Quartz in the rim contains impurities(black dots). (crossed nicols)

Fig.21: Hand specimen showing spherulites of aggregation type with fine grain rim. Color of the spherulites are

greyish white to reddish purple. Size of the aggregation type with fine grain rim is less than 1cm in diameter and the host rock is dense and compact.

Fig.22: Typical texture of the aggregation type with fine grain rim. The core is composed of large crystals of pyrophyllite(A), the middle part of small quartz crystals(B) and the rim of fine crystals of pyrophyllite(C). (crossed nicols)

Fig.23: The spherulite is composed of mostly fine grained quartz and pyrophyllite(A and B) and the core contains relatively large pyrophyllite crystals. C grain is composed of fine quartz crystals. (crossed nicols)

Fig.24: Relatively large spherulites with dark purplish color.

Fig.25: Microscopic texture of spherulite shown in Fig.24. The core is composed of fine grained pyrophyllite(A) whereas the rim composed of quartz and opaque minerals (B). Pseudomorph after plagioclase is filled by fine pyrophyllite(C). (crossed nicols)

Fig.26: High magnification photograph of the B part shown in Fig.25. The optical properties of the mineral are similar to those of hematite. Exact identification of the mineral is not yet done. (Reflection microscope using oil immersion lens)

Fig.27: Ditto. Doughnuts like opaque mineral grains. Note that needle-shaped fine opaque mineral crystals are arranged radially. (Reflection microscope with oil immersion lens)

Fig.28: Aggregation type with fine grained rim. Pyrophyllite in the core is arranged somewhat radially(A). The rim is composed of fine quartz(B). (crossed nicols)

Fig.29: Hand specimen showing spherulites with whitish and dark bluish color.

Fig.30: Microtextures of spherulites shown in Fig.29. The core is composed of quartz(A) and the rim of fine hematite(B). Note that the core is free from iron(hydro-) oxide. (crossed nicols)

Fig.31: Marginal part of the spherulite shown in Fig.30. Note that the iron oxide(black) concentrates in the rim which separates the spherulite sharply from the matrix. (crossed nicols)

Fig.32: Hand specimen showing relatively large spherulites(3～10mm in diameter).

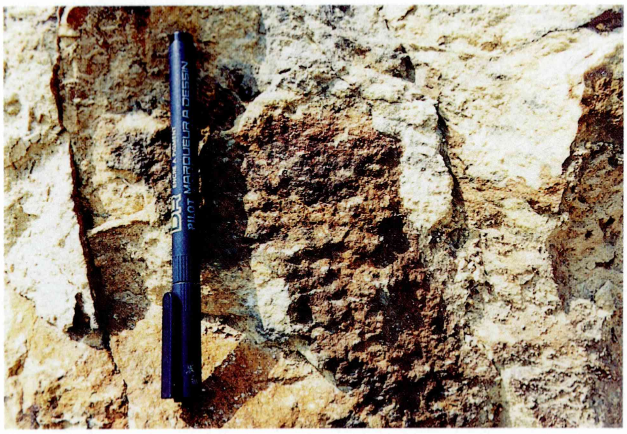
Fig.33: Microtextures of spherulites shown in Fig.32. The outermost part of the spherulite is composed of alunite(A). Inside of the spherulite is mostly composed of fine quartz. Aggregations of pyrophyllite are also present(B). (crossed nicols)

H.OGASAHARA, M.JIGE, Y.YAMASHITA, M.OHKAWA, R.KITAGAWA, and S.TAKENO: Department of Earth and Planetary Sciences, Faculty of Science, Hiroshima University, Higashi-Hiroshima 739-8526, Japan.

A.NAKASHIMA: Shokozan Mining Co.Ltd., Hon-machi, Shobara, 727-0006, Japan.

Fig. 1.

Fig. 2.



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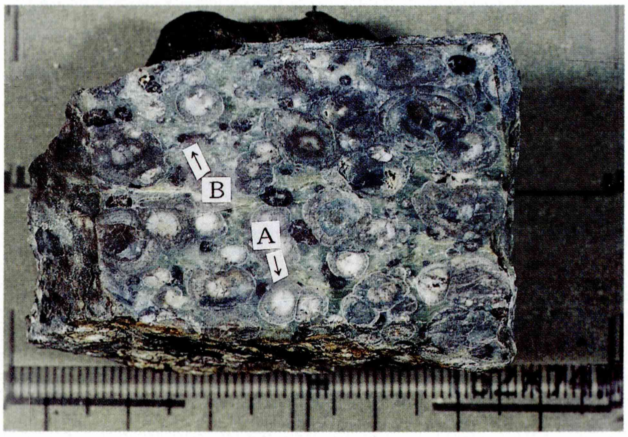

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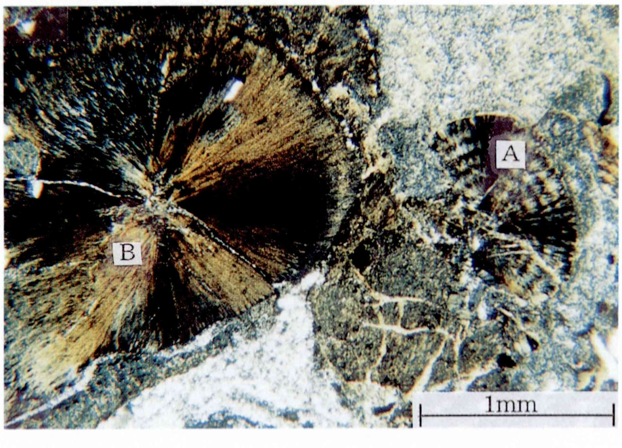

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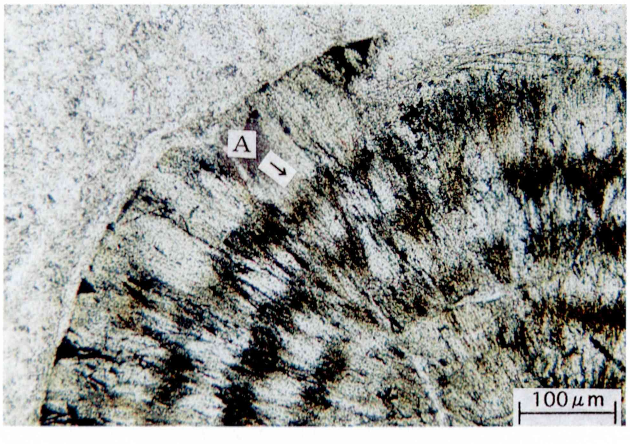

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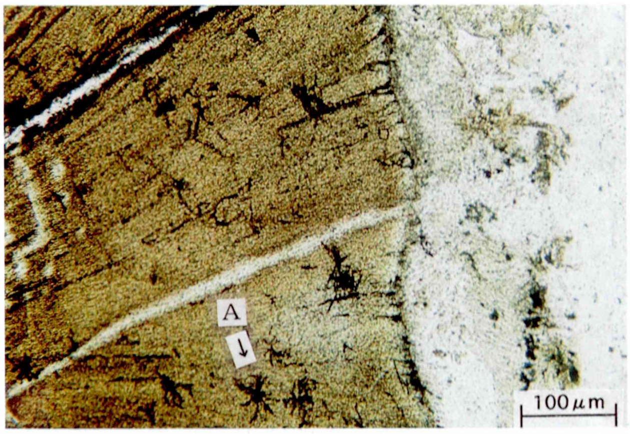

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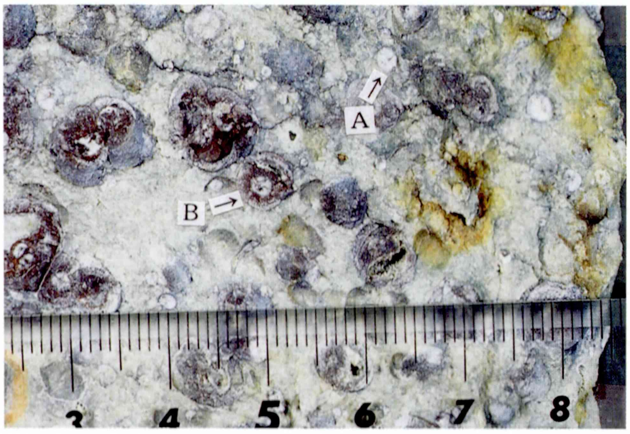

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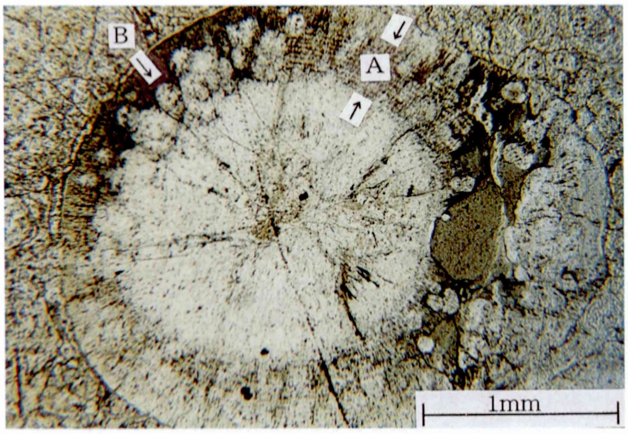

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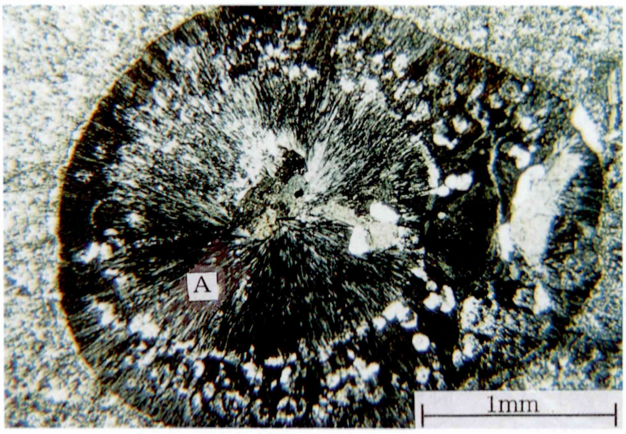

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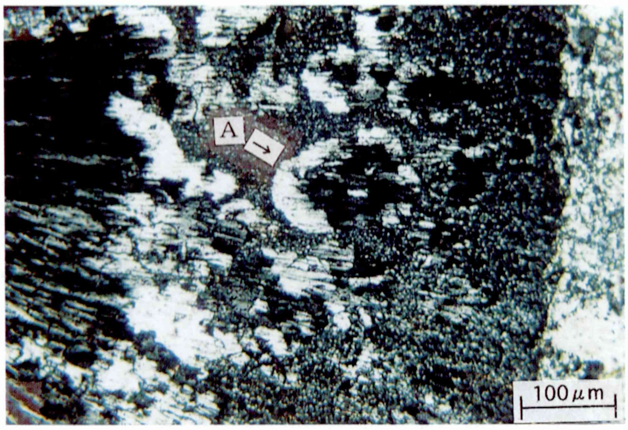

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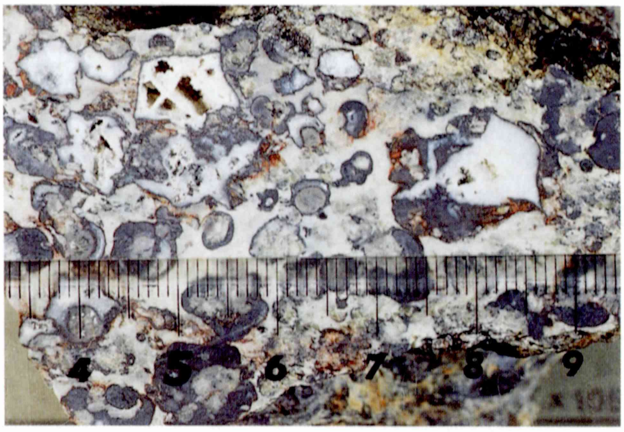

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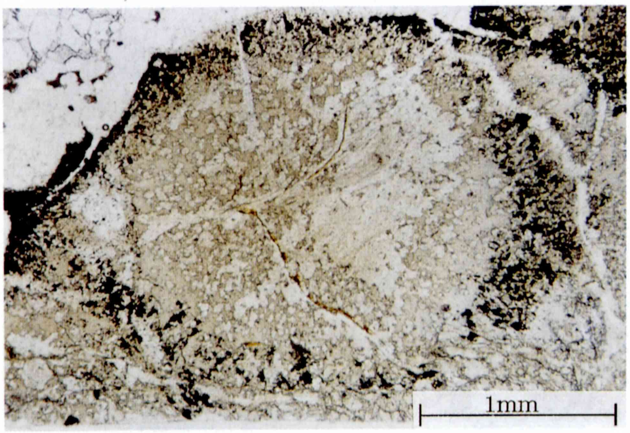

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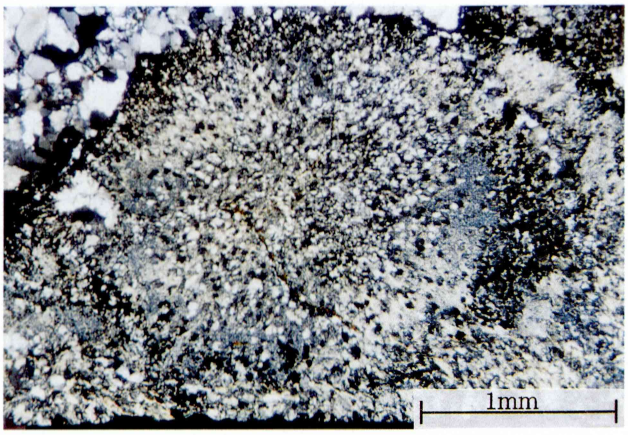

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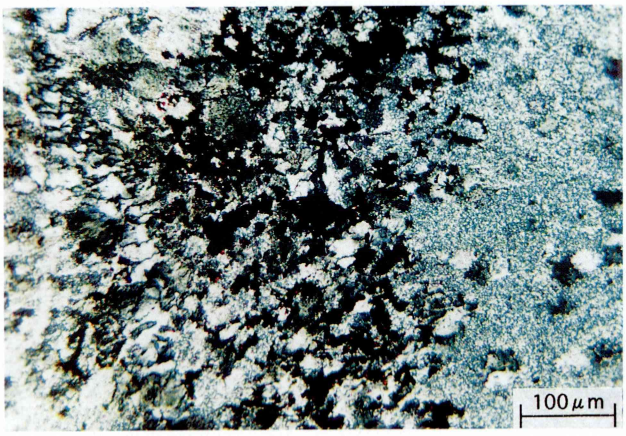

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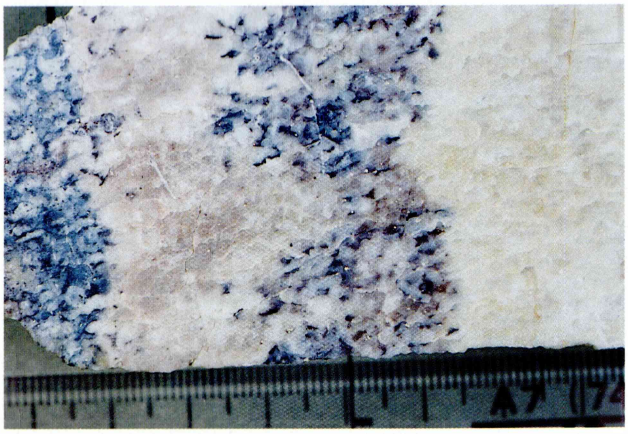

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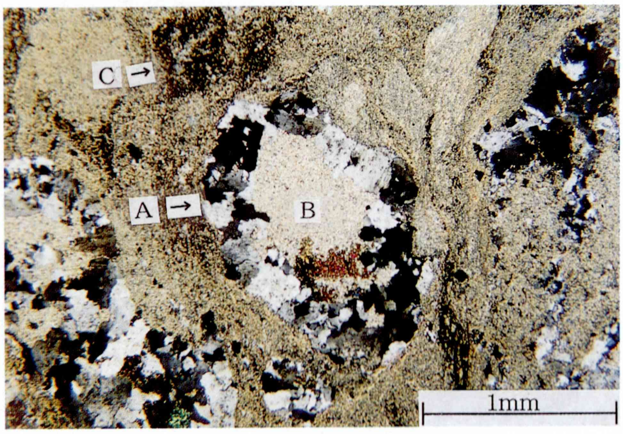

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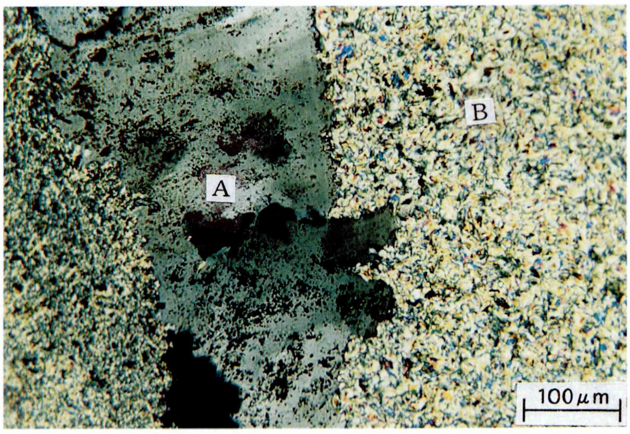

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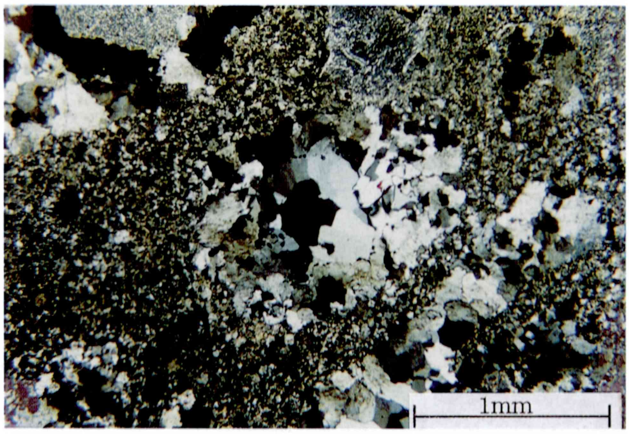

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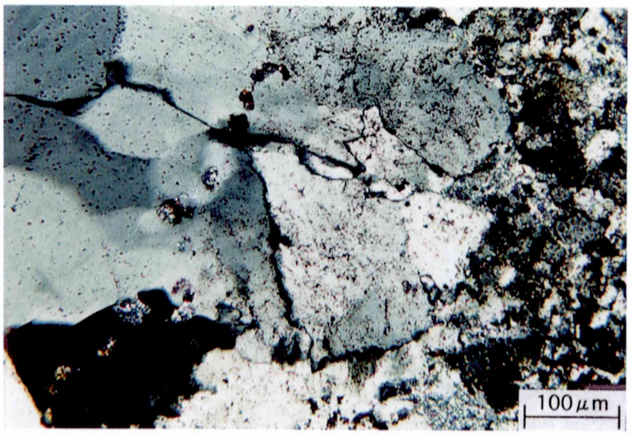

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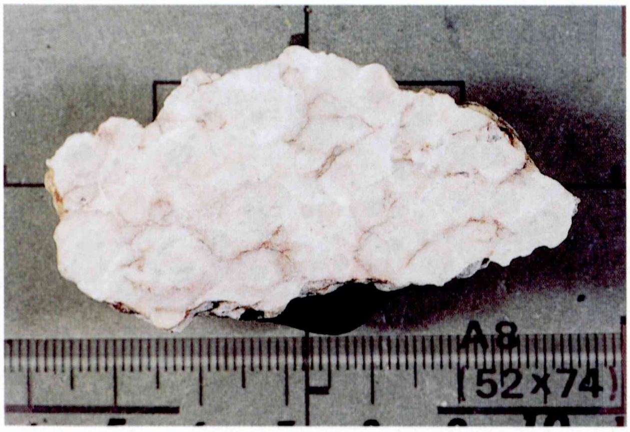

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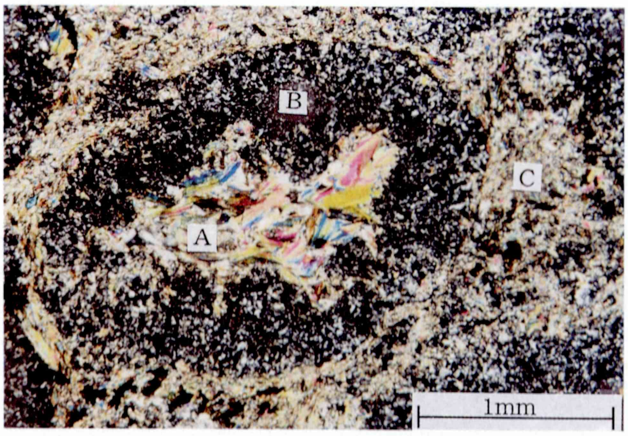

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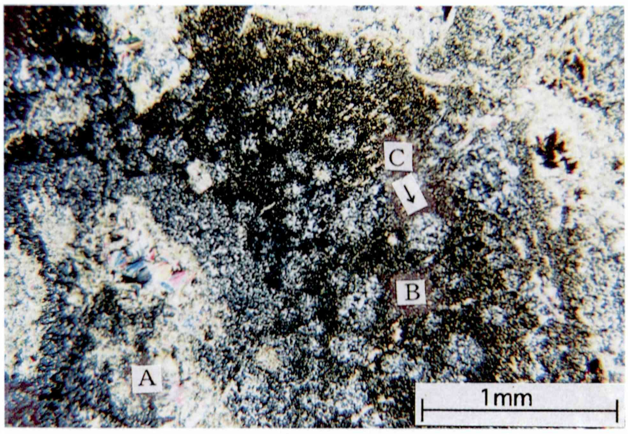

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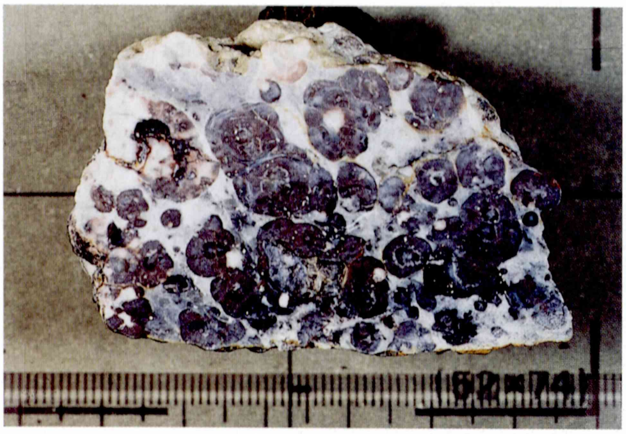

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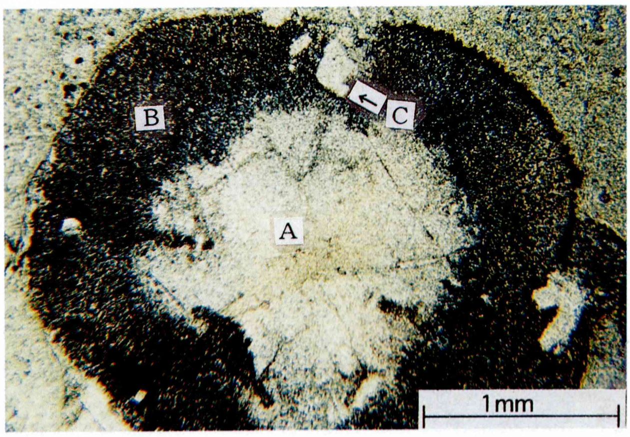

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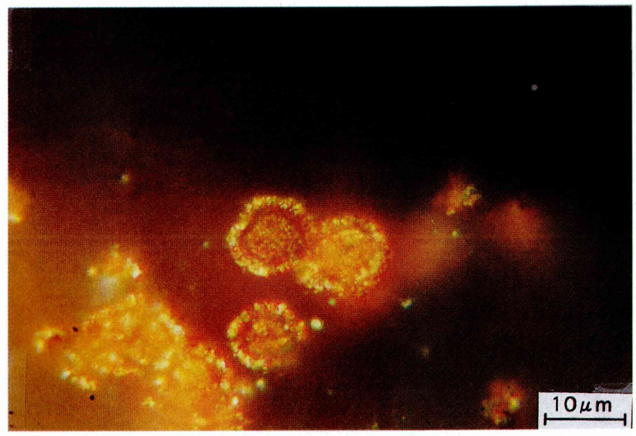

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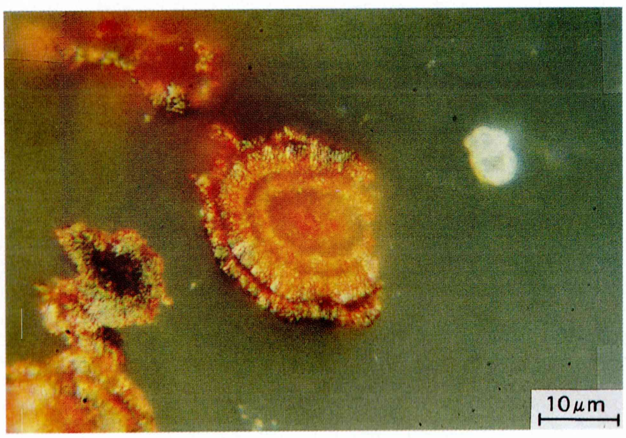

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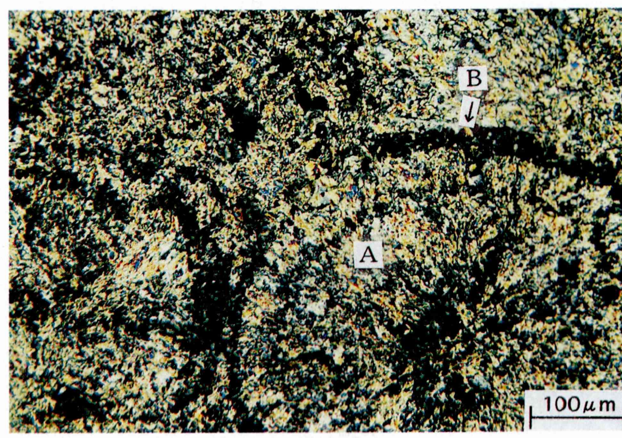

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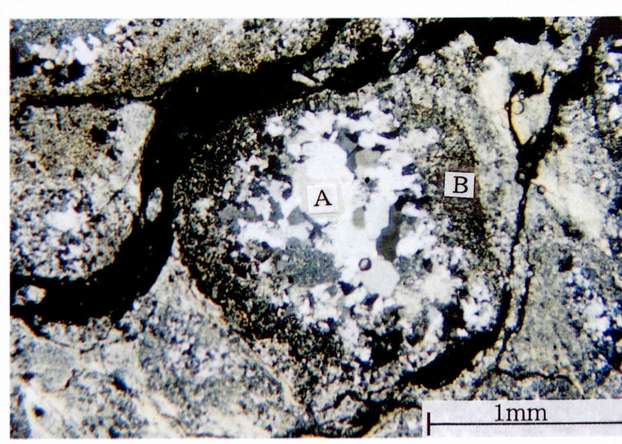

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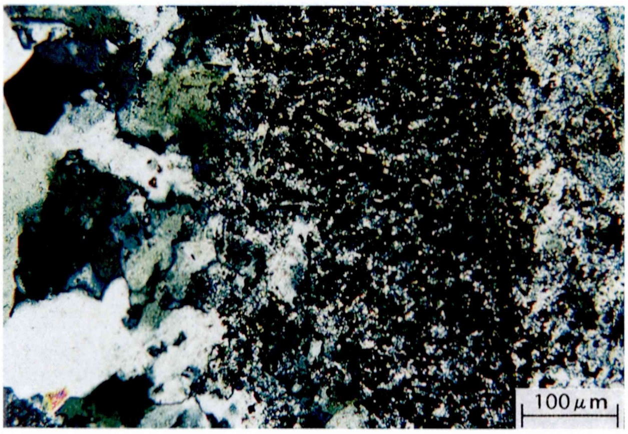

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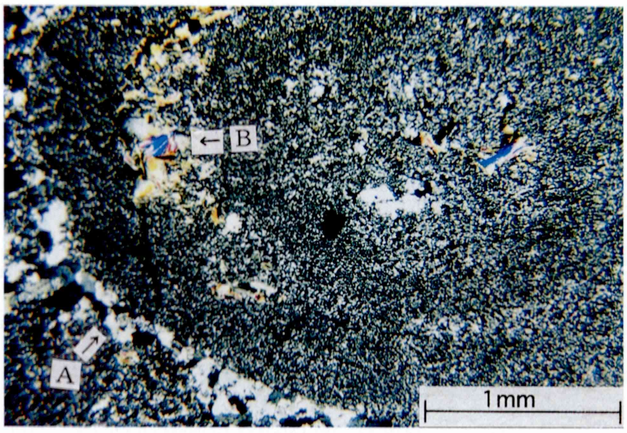

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