

PREHNITIZATION IN THE IMPURE CALCAREOUS BANDS OF SANKARIDRUG,
SALEM DISTRICT, TAMIL NADU, INDIA

S. SARAVANAN, G. THIMMI CHETTY AND S. RAMANATHAN

Department of Geology, Presidency College, Madras

During the course of geological investigation in the Sankaridrug area, Tamil Nadu, a pale green mineral associated with quartz, diopside and grossularite occurring in the impure metamorphosed limestone was collected. The mineral exhibits radiating structure and shows vitreous to pearly lustre. It is subtransparent and the fragment becomes colourless when the mineral is powered. The S. G. of the mineral is 2.97.

Under the microscope, the mineral is colourless and exhibits radiating and sheaf texture. The relief of the mineral is high; and lamellar twinning is observed in a few grains. The mineral seems to have formed at the expense of calcite. The mineral was subjected to optical, chemical and X-ray investigations and was identified as prehnite. The results are tabulated with the data depicting the various characters of prehnite reported and described by Yoshimura, *et. al.* (1966) and Nuffield (1943).

TABLE I
OPTICAL CHARACTERS

| 1 | 2 | 3 |
|-------|----------|--------------|
| 1.611 | 1.613 | 1.615 |
| 1.619 | 1.622 | 1.629 |
| 1.634 | 1.639 | 1.644 |
| 0.023 | 0.26 | 0.29 |
| 58 | 60 to 65 | 69 (Calc-68) |

TABLE II
CHEMICAL COMPOSITION

| Constituents | 1 | 2 | 3 | Niggli Values : 1 |
|--------------------------------|-------|--------|-------|-------------------|
| SiO ₂ | 42.48 | 43.24 | 41.67 | si = 91.15 |
| TiO ₂ | nil | tr. | 0.12 | al = 31.99 |
| Al ₂ O ₃ | 24.26 | 24.93 | 24.44 | fm = 2.01 |
| Fe ₂ O ₃ | 0.58 | 0.45 | 1.03 | c = 66.00 |
| FeO | 0.20 | 0.03 | 0.32 | alk = nil |
| MnO | — | tr. | — | k = nil |
| MgO | 0.16 | 0.67 | 0.25 | mg = 0.26 |
| CaO | 27.45 | 26.46 | 27.25 | |
| Na ₂ O | nil | 0.27 | 0.18 | |
| K ₂ O | nil | 0.14 | 0.18 | |
| H ₂ O ⁺ | 4.44 | 4.02 | 4.44 | |
| H ₂ O ⁻ | — | 0.02 | — | |
| | 99.57 | 100.23 | 99.88 | |

1. Prehnite, Sankaridrug, Tamil Nadu, India
Analyst : G. Thimmi Chetty
2. Prehnite, Hokuba-mura, Nagona, Japan
3. Prehnite, Ashcroft, British Columbia
Analyst : E. W. Nuffield

The analysis of the mineral has been recalculated adopting Warren's formula and is given in Table III.

TABLE III

| Constituents | Wt% | Cations in 24 (O, OH, F) | | |
|--------------------------------|-------|-----------------------------|----|-------|
| SiO ₂ | 42.48 | 6.024 | .. | 6.024 |
| TiO ₂ | nil | | | |
| Al ₂ O ₃ | 24.26 | 4.047 | } | 4.174 |
| Fe ₂ O ₃ | 0.58 | 0.068 | | |
| FeO | 0.20 | 0.025 | | |
| MnO | — | — | | |
| MgO | 0.16 | 0.034 | } | 4.168 |
| CaO | 27.45 | 4.168 | | |
| Na ₂ O | nil | — | | |
| K ₂ O | nil | — | | |
| H ₂ O | 4.44 | 4.196 | .. | 4.196 |

The Warren's formula for the mineral is

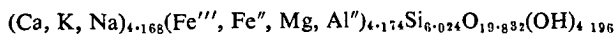


TABLE IV
X-RAY UNIT CELL DIMENSION

| | 1 | 2 |
|---|---------|--------|
| a | 4.596 Å | 4.60 Å |
| b | 5.52 | 5.46 |
| c | 18.7 | 18.44 |

1. Prehnite, Sankaridrug, Tamil Nadu, India

2. Prehnite, Ashcroft, British Columbia

Analyst: E. W. Nuffield

| Prehnite-Sankaridrug | |
|----------------------|-----|
| dÅ | I |
| 5.1562 | 10 |
| 4.5132 | 10 |
| 3.4139 | 65 |
| 3.224 | 55 |
| 3.0183 | 90 |
| 2.7659 | 40 |
| 2.5799 | 5 |
| 2.5291 | 100 |
| 2.326 | 20 |
| 2.2902 | 10 |
| 2.1097 | 5 |
| 2.0502 | 5 |
| 1.9219 | 10 |
| 1.8354 | 15 |
| 1.7596 | 45 |
| 1.6905 | 5 |
| 1.6556 | 15 |
| 1.6157 | 15 |
| 1.5372 | 25 |
| 1.5012 | 15 |
| 1.4029 | 20 |
| 1.3668 | 10 |
| 1.2915 | 15 |
| 1.208 | 10 |
| 1.127 | 15 |

Discussion: Several theories have been advocated by different authors for the formation of Prehnite depending on the modes of occurrence. This may be summarised as follows:

1. As veins, cavities, and nodules in basic volcanic rocks. (Walker, T. L. and Parsons, A. L., 1926)
2. As veins and pseudomorphs in granite and allied acid rocks. (Deer, W. A., Howie, R. A. and Zussman, J., 1962)
3. As a product of incipient metamorphism in rocks like greywackes. (Coombs, *et al*, 1959)
4. As an alteration product along the contact of impure limestones with any intrusive rocks. (Bilgrami, S. A. and Howie, R. A., 1960)

In the present investigation the examination of the thin section of the impure limestone specimen collected at regular intervals from the contact of the rock with intrusive granites has clearly revealed the effect of pneumatolytic agencies, generated during the final phase of consolidation of the latter (Harker, 1950). Only a few grains of calcite are converted to prehnite. The other calc-alumino-silicate, grossularite, which is normally susceptible to such hydrolytic action is left unaltered. This indicates the low temperature of the hydrothermal solution and its lack of concentration in chlorine, fluorine, and boron. The mineral assemblage calcite-prehnite-quartz fixes the rock in a subfacies lying between the zeolite and typical greenschist facies (Coombs, *et al* 1959) suggesting the temperature of alteration as $300^{\circ}\text{C} \pm 50^{\circ}\text{C}$. This conforms to the meagre degree of prehnitization observed in the rock. This is in accordance with the mode of origin suggested by several authors for the formation of prehnite occurring in impure limestones adjoining the intrusives.

Acknowledgements: The authors wish to thank Mr. P. A. Ananthakrishnan for taking photographs and Mr. P. K. Ponnuswamy for the X-ray interpretation.

REFERENCES

- BILGRAMI, S. A. and HOWIE, R. A., (1960) The mineralogy and petrology of a Rodingite dike, Hindubagh, Pakistan, *Amer. Min.*, v. 45, p. 791.
- COOMBS, D. S., ELLIS, A. J., FYFE, W. S. and TAYLOR, A. M., (1959) The zeolite facies with comments on the interpretation of hydrothermal synthesis, *Geochim. et Cosmochim. Acta*, v. 17, pp. 53-107.
- DEER, W. A., HOWIE, R. A. and ZUSSMAN, J., (1962) *Rock Forming Minerals*, v. 3, Longmans Publications.
- HARKER, A., (1950) *Metamorphism*, Methuen & Co., Ltd., London
- NUFFIELD, E. W., (1943) Prehnite from Ashcroft, British Columbia, *Univ. Toronto Stud., Geol. Ser.*, no. 48, pp. 49-64.
- WALKER, T. L. and PARSONS, A. L., (1926) Zeolites and related minerals from Lake Nipigon, Ontario, *Univ. Toronto Stud. Geol. Ser.*, no. 22, p. 15.
- YOSHIMURA, T., HAYASHI, M. HANISHI, O., (1966) Prehnite from Hokuba-mura Nagoya, Japan, *Jour. Min. Soc. Japan*, pp. 84-93.