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THE AENIGMATITE-BEARING ALKALINE ROCKS FROM THE PRAKASAM AND NELLORE DISTRICTS OF ANDHRA PRADESH

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DURING a petrographic investigation of certain syenitic and granitic rocks found in some parts of the Prakasam and Nellore districts of Andhra Pradesh, the presence of a rare accessory mineral aenigmatite ($\text{Na}_2\text{Fe}^{+2}\text{TiSi}_6\text{O}_{20}$) has been recorded. As far as the writers are aware, this is believed to be the first published report of aenigmatite occurrence in India. In the recently recognised alkaline province¹, aenigmatite has so far been observed from the silica-over-saturated and saturated alkaline rocks (granites, quartz-bearing syenites, and quartz- and foid-free syenites), and the mineral is almost absent in the silica under-saturated rocks (nepheline syenites). To be more

specific, aenigmatite is found in: (a) the syenites (quartz-bearing and quartz- or foid-free) of Settupalle ($16^\circ 01' \text{N}$ and $79^\circ 52' \text{E}$); (b) the nepheline-poor syenites (nepheline $< 2\%$ vol) of Enakonda ($16^\circ 33' \text{N}$ and $80^\circ 01' \text{E}$); (c) the hornblende syenites (quartz- and foid-free) and granites of Uppalapadu ($15^\circ 35' \text{N}$ and $79^\circ 46' \text{E}$); (d) the granites of Darsi ($15^\circ 46' \text{N}$ and $79^\circ 41' \text{E}$) and Kanigiri ($15^\circ 25' \text{N}$ and $79^\circ 30' \text{E}$) areas; and (e) the quartz syenites of Kotappa Konda ($16^\circ 08' \text{N}$ and $80^\circ 02' \text{E}$) and Purimetla ($15^\circ 53' \text{N}$ and $79^\circ 51' \text{E}$). The nepheline syenites occurring near Elchuru ($16^\circ 05' \text{N}$ and $79^\circ 56' \text{E}$), Purimetla and Uppalapadu are found to be devoid of aenigmatite.

In thin sections, aenigmatite forms slightly or prominently elongated crystals of dark chestnut-brown colour; the mineral has been identified from the following optical properties:

- (a) Pleochroism: $X =$ yellow or yellowish-brown
 $Y =$ dirty brown
 $Z =$ dark chestnut-brown
- (b) Absorption scheme: $Z > Y > X$
- (c) Extinction angle: $Z \wedge c = 42^\circ - 45^\circ$
- (d) Sign and optic axial angle: +ve, $35^\circ - 40^\circ$
- (e) Birefringence: 0.066
- (f) Refractive index: $N_g = 1.799 - 1.810$.

Though cleavages are seen in some grains, they are rather indistinct, the mineral rarely shows simple twinning. In the hornblende syenites of Uppalapadu, the aenigmatite crystals show zoning, which may be intense or feeble. Larsen², while reporting the occurrence of zoned aenigmatite from the Ilimaussaq intrusion, South Greenland, has observed that zoning in these aenigmatites is caused by the enrichment of Ca, Al, and Fe^{+3} near the core and Ti towards the rim.

The other minerals that can sometimes be mistaken for aenigmatite are astrophyllite and lamprophyllite, which can also occur in alkaline rocks, but a clear distinction is possible when their optical properties are compared with those of aenigmatites³⁻⁵.

Aenigmatite—a typically alkaline mineral of high Na/Al ratio⁶—is a fairly common constituent of sodium—and titanium-rich peralkaline rocks formed under low T and $f\text{O}_2$ ^{7,8}. The mineral has been reported as an accessory from a number of well-known alkaline provinces and complexes of the world, e.g., Nigeria-Niger province (West Africa)⁹, Mongol-Tuva province¹⁰ and Kola Peninsula (U.S.S.R.)¹¹, Gardar province (South Greenland)^{12,13} and the Redwine¹⁴ and Coldwell¹⁵ alkaline complexes (Canada).

From these descriptions it is quite clear that the presence of aenigmatite is a conspicuous manifestation of the peralkaline or agpaite character of the rocks in

which it occurs, but at the same time, the mineral's absence need not necessarily be construed as an indication of the miaskitic or non-peralkaline nature of the rocks. In other words, the peralkaline or agpaitic rocks may or may not contain aenigmatite but the non-peralkaline or the miaskitic rocks, as a rule, are devoid of this mineral. If this generalised logic is extended to the alkaline rocks of Prakasam and Nellore districts, then it may be supposed that most of the granites and syenites occurring in these areas are undoubtedly peralkaline in character since they have developed aenigmatite, but regarding those rocks which are devoid of aenigmatite it remains to be established whether or not they are peralkaline.

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ALGAL STROMATOLITE FROM THE VEMPALLI FORMATION NEAR PULIVENDLA

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The identification of Onkolito (Algal Stromatolite) in the Vempalli formation near Pulivendla indicates

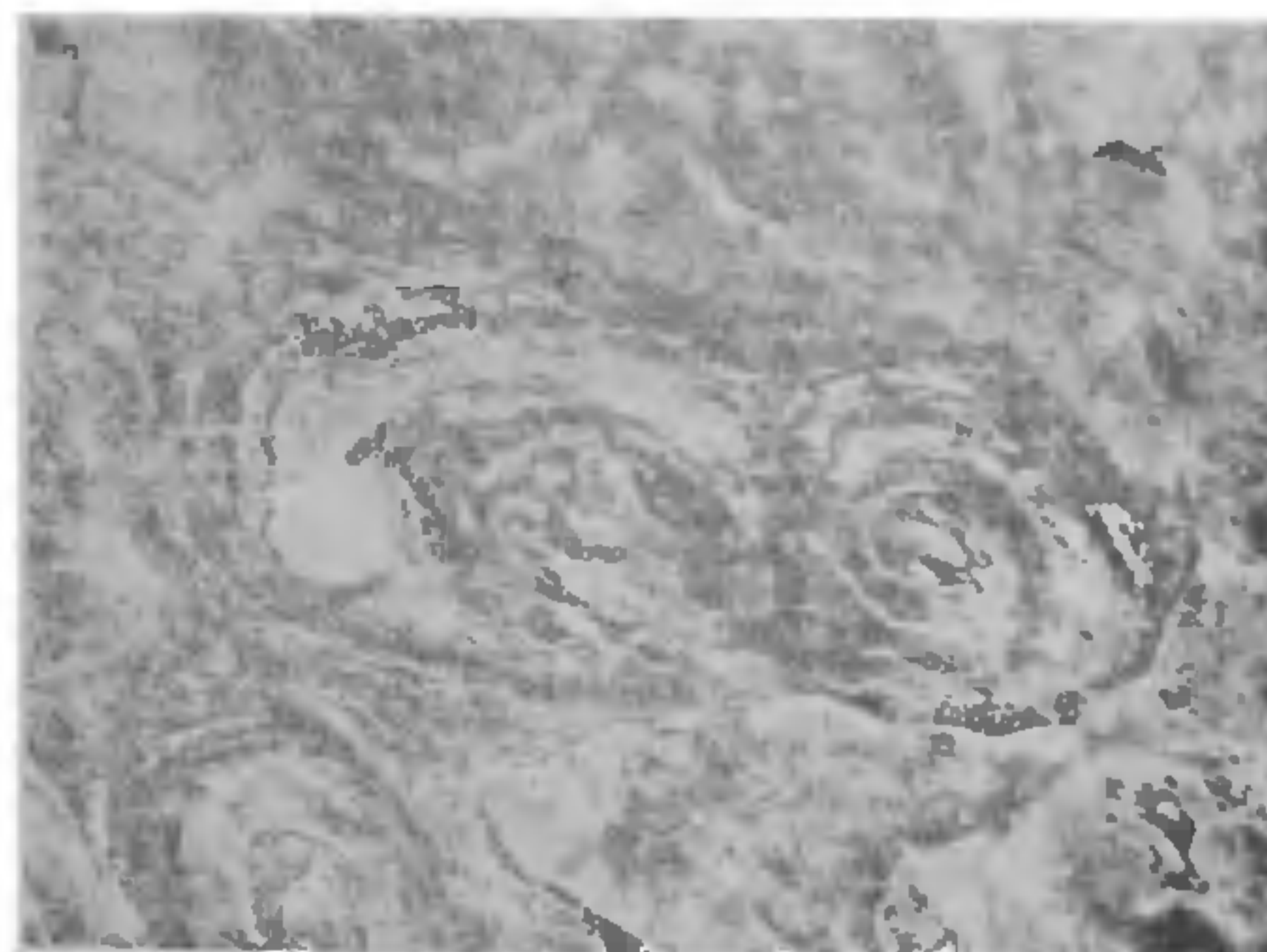


FIG. 1



FIG. 2

that the formation was deposited under shallow marine conditions.

The Vempalli formation of Pulivendla area belongs to the Papaghni Group of the Cuddapah Supergroup. This mainly consists of dolomite, dolomitic limestone, stromatolitic dolomitic limestone, oolitic dolomitic limestone and some intercalations of siliceous and argillaceous bands. The stromatolites are conspicuously noticed on the weathered surfaces of dolomitic limestone near Medipenta ($14^{\circ}20' : 78^{\circ}19'$), Bakkanagaripalli ($14^{\circ}20' : 78^{\circ}12'$) and Veliderdla ($14^{\circ}33'40'' : 78^{\circ}2'$). The cherty or siliceous layers of stromatolitic dolomitic limestone remain unaffected and the carbonate material leached out resulting in a rugged layered surface, helps for its easy recognition.

In these areas stromatolites occur in circular or oval (Fig. 1) and elongated (Fig. 2) forms. They are flat-lying and spheroidal in outline. They consist of laminae disposed around a nucleus resembling the growth of a laminated structure around a fragment.