

Note on Sapphirine and Kornerupine in South India

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In a paper on sapphirine, kornerupine, and sillimanite + orthopyroxene from South India that was recently published in this Journal (Grew, 1982), I referred to a sapphirine locality near Elchuru (#14) and kornerupine localities near Paderu (#22). The purpose of the present note is to correct some statements in my 1982 paper concerning localities #14 and 22, and to communicate some additional mineralogical information on the Paderu rocks, which include a unique suite of high-grade boron-bearing granulites.

The sample Dr. M. Ramakrishnan made available to me from locality #14 was collected by Dr. K. N. Rao (personal communication, 1983). In his 1983 communication to me, Dr. Rao further writes that the exact location for #14 lies about 1.5 km southwest of Mukteswaram ($15^{\circ}59'30''$ N; $79^{\circ}59'0''$ E) or about 12 km southeast of Elchuru. The Mukteswaram sample consists largely of sapphirine, orthopyroxene, biotite, and spinel; accessory rutile and a trace of plagioclase are also present. Spinel is enclosed in sapphirine. K. N. Rao *et al* (in press) describe in detail the sapphirine-bearing rocks from this locality.

Kornerupine is present in several of the samples collected by C. S. Middlemiss from the Paderu area (Higgins *et al* 1979; Grew, 1982; R. K. Herd, personal communication to E. S. Grew, 1981). Through the generosity of R. I. Gait, Curator of Mineralogy at the Royal Ontario Museum in Toronto, I have been able to examine Walker's and Collins' thin sections of Middlemiss' rocks, as well as pieces of Middlemiss' samples. In addition, R. K. Herd provided me with a piece of the kornerupine-bearing rock (E2724) described by Higgins *et al* (1979). Royal Ontario Museum specimens E2724 and E2730 correspond to Walker and Collins (1907) register numbers 16.171 and 16.191, respectively. These specimens are distinct and E2730 is not a part of #16.171, as was stated on p. 478 of my 1982 paper. The Royal Ontario Museum label gives the locality for E2724 as 'Jeypore Zemindari' and for E2730 as 'Vizagapatam district'. However, C. S. Middlemiss (1903, p. 25) reports that he collected the samples from a band extending 'some 30 miles from Guda to Sampangputi' in the Vizagapatam hill tracts. Walker and Collins (1907, p. 3) state that 'the rocks here considered were collected from a small area that may be defined as lying near the villages of Gangrez Madgul (probably the modern Gangarājumādugulu at $18^{\circ}01'N$, $82^{\circ}32'E$), Ontali (Ontālāyi at $18^{\circ}00'30''N$, $82^{\circ}37'30''E$), and Pader (Paderu, $18^{\circ}5'N$, $82^{\circ}40'E$) in Madgul taluq, Vizagapatam district. . .'. Thus, both specimens are probably from the Vishakhapatham (Vizagapatam) district. E2724 and the portion of E2730 obtained from R. K. Herd (Grew, 1982) consists of kornerupine, sapphirine, sillimanite, spinel, biotite, hemo-ilmenite, and corundum. In addition, grandidierite occurs sparingly in both rocks. Grandidierite has not previously been reported from India, and a description of the Paderu grandidierite is being published separately (Grew, in press). Kornerupine is absent in a second portion of E2730, which was provided by R. I. Gait. This portion consists largely of sapphirine, biotite, and orthopyroxene. Other constituents are spinel, which is enclosed by sapphirine, accessory zircon, and traces of K-feldspar. To the author's knowledge, E2730 is the only non-migmatitic sapphirine-bearing rock from South India to

contain K-feldspar in contact with sapphirine (Grew, 1982, p. 475). Moreover, E2730 (=16.191) appears to be a composite specimen similar to 16.171, which Walker and Collins (1907, p. 6-7) described in detail. Kornerupine is also present in two thin sections catalogued by the Royal Ontario Museum as E2729. One section, which corresponds to Walker and Collins register number 16.173 (labelled 16.173B), is a sillimanite-rich schist containing subordinate kornerupine, spinel, opaque, traces of biotite, and two unidentified minerals (possibly monazite and rutile). The other section was also cut from a sillimanite-rich rock, which contains large sapphirine grains, kornerupine, spinel, opaque, and traces of biotite. No Walker and Collins (1907) register number is given for this thin section, but the mineralogy suggests it was cut either from 16.173 or from the sillimanite-rich portion of 16.171 as described by Walker and Collins (1907).

It is hoped that this summary of the mineralogy of C. S. Middlemiss' kornerupine-bearing samples will stimulate further work in the granulite-facies rocks of the Paderu area and other parts of the Vishakhapatnam district. The metamorphic terrane exposed in this district, which is characterized by the high temperature 'dry' (low P_{H_2O}) assemblages, sapphirine-quartz and sillimanite-orthopyroxene (Grew, 1982), is one of the highest-grade terranes in India. Moreover, the Paderu kornerupine-bearing rocks are among the few borosilicate assemblages reported from such a high-grade terrane anywhere. A petrologist working near Paderu should be rewarded with a wide variety of kornerupine and sapphirine-bearing assemblages.

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