Proterozoic calc-silicate rocks of the Oaxaca complex (southern Mexico): an example of sabkha evaporites

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The Precambrian Oaxacan complex in southern Mexico covers an area of 10,000 km^2. This complex is unconformably overlain by Late Cambrian to Early Ordovician metasedimentary rocks. The complex underwent granulite facies metamorphism during the time interval from 1,100 to 1,000 Ma. The complex is about 15 km thick and includes, in stratigraphic order from the bottom, (1) mafic orthogneiss and anorthosite, (2) migmatite gneiss, (3) paragneiss, (4) metagabbro and syenite, and (5) charnockite. Concordant and discordant bodies (~1.5 m thick) of calc-silicate rocks occur in the paragneiss. The intrusive calc-silicate rocks contain mineral assemblages ranging from titanite + scapolite + diopside + K-feldspar + calcite ± quartz to calcite + scapolite + forsterite + titanite + spinel ± Ca-rich amphibole. These mineral assemblages are consistent with granulite facies metamorphic conditions. U-Pb isotopic dating of titanite in a cross-cutting calc-silicate body yielded a date of 969 Ma that is interpreted as a cooling age. This age is similar to that of the pegmatites in the underlying anorthosite. Geochemically, calc-silicate rocks are characterized by SiO_2 ranging from 5 to 25 wt. % and low Rb/Sr ratios (<0.12). Their low abundances of high-field-strength elements and rare earth elements, which display unfractionated chondrite-normalized patterns, differ from those of carbonatite and skarns. The presence of scapolite, the concordant nature of many calc-silicate bodies, and their stratigraphic position within the sequence suggest that these calc-silicates are sabkha evaporite deposits metamorphosed under granulite facies conditions. These metamorphic conditions induced mobilization of calc-silicate rocks that can account for the dike-like calc-silicate bodies within the Oaxacan stratigraphic sequence. The abundance of these rocks in the Oaxaca complex implies that evaporite environments in Precambrian time were not as rare as generally assumed.