Methane-, ethane- and hydrogen-bearing carbonic fluid inclusions in ultrahigh-temperature metamorphic rocks

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Methane, ethane, and hydrogen (Hydrocarbons) with CO2-rich fluid inclusions in an ultrahigh-temperature metamorphic rockMethane-, ethane-, and hydrogen-bearing carbonic fluid inclusions have been found in ultrahigh-temperature granulites from the Archean Limpopo Belt, South Africa. The rock occurs as concordant leucocratic layer within pelitic granulite probably formed by partial meting during high-grade metamorphism, possibly up to ultrahigh-temperature condition. Carbonic fluid inclusions are present as a secondary phase cutting quartz grains in the leucosome, suggesting its entrapment at exhumation stage. Raman spectroscopic study of the inclusions identified sharp peaks of CH4 as well as minor C2H6 and H2 peaks. Although such reduced carbonic fluids have been reported from mantle materials as a product of polymerization of methane (CH4 = C2H6 + H2), this is the first report of such a reduced fluid and polymerization reaction at middle crust (less than 0.5 GPa).