Formation of anthophyllite + plagioclase in a retrograded mafic granulite from Palghat Cauvery Shear Zone, India: Constraints on fluid composition and element mobility

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The Granulitic Terrane of South India exposes diverse variety of mafic and ultramafic enclaves, hosted within felsic orthogneiss. These Archean rocks are dissected by a number of crustal scale shear zones. In one of these shear zones (Palghat Cauvery Shear Zone, PCSZ), mafic and felsic granulites are intensely deformed and extensively altered to amphibolite facies ensembles that contain rare and exotic mineral assemblages. Within few of such retrograded mafic granulite enclaves, garnet and hornblende breaks down to anthophyllite + plagioclase intergrowth. Integrating textural relations, chemical compositions and volume proportions of minerals, a balanced chemical reaction has been obtained:

3.4 Grt + 16.7 Hbl + 53.1 SiO_2^{aq} + 16.5 Mg^{+2} + 10.9 Fe^{+2} = 14.5 Ath + 24.6 Pl + 10.2 Ca^{+2} + 1.3 K^{+1} + 2.2 H_2O….. (1)

Combining all the evidences with the stoichiometrically balanced reaction, it is proposed that the anthophyllite + plagioclase symplectite was formed due to the interaction of the mafic rock with an externally derived aqueous fluid rich in silica and Mg^{+2}. Available experimental data supports that the aqueous fluid was rich in brine that increased its capacity of transporting SiO2 and other cations required to drive reaction (1).