

Origin of hydrothermal fluids and gold mineralization associated with the Ventersdorp Contact Reef, Witwatersrand Basin, South Africa: Constraints from S, O, H, C isotopes

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The Ventersdorp Contact Reef (VCR), one of the major gold-bearing conglomeratic reef horizons in the Witwatersrand Basin occurs between the overlying Klipriviersberg Group lavas (2714 Ma) and the underlying Central Rand Group sediments (2894 - >2714 Ma). It was metamorphosed and hydrothermally altered under *T-P* conditions of 290 to 350 °C and 2 to 3 kb. A narrow range of $\delta^{34}\text{S}$ values (-1,5 - +1,8‰) for authigenic pyrite, pyrrhotite, chalcopyrite, sphalerite and galena suggests a dominantly magmatic-derived source of sulphur. $\delta^{18}\text{O}$ values for authigenic quartz and calcite range from +8,9 to +11,3‰. $\delta^{18}\text{O}$ and δD values of muscovite-dominated separates are between +7.2 - +8.4‰ and -62 and -31‰, respectively. The estimated $\delta^{18}\text{O}$ (+4.8 - +6.1‰) and δD (-6 - -39‰) values of the fluids under the *T-P* conditions suggested above, indicate a metamorphic origin. In addition, estimated $\delta^{13}\text{C}$ values (-18,4 - -20,0‰) of graphite (bitumen) from vein calcite (-8,4 - -10,0‰) indicate an organic source of the carbon. Given that the metamorphic fluids involved were probably internally derived, it is suggested that allogenic sulphides in the VCR were reconstituted during fluid circulation at peak metamorphic conditions. Gold may also have been remobilized at this stage.