

MOLECULAR STABLE ISOTOPIC APPROACHES IN THE GEOLOGICAL ENVIRONMENT: A BREAKTHROUGH IN MINEROGENETIC STUDIES. EXAMPLES ON SEDIMENT-HOSTED ORE DEPOSITS.

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The isotopic composition of individual organic compounds are particularly sensitive to the type of organic source, formation, and post-depositional processes, including changes in the P-T conditions in the sedimentary sequence, thermal maturity, biological and chemical mediated degradation, mixing, and phase separation effects. Recent technical developments in hyphenating the molecular resolution of gas chromatography (GC) with the sensitivity of isotope ratio mass spectrometry (IRMS) through a combustion (C) interface (GC/C/IRMMS) allows the determination of the carbon, nitrogen, oxygen, and hydrogen isotope composition of individual organic substances. In this contribution we discuss the applicability of our new data to economic geology. Three case studies from sediment-hosted base and precious metal deposits will be summarized: (i) the Mississippi Valley-type (MVT) zinc-lead deposits hosted in the dolomitic units of the Triassic-Jurassic Pucará basin (Peru), (ii) uraniferous bitumens in the Late Variscan hydrothermal vein-type uranium deposit of Příbram (Czech Republic), and (iii) the gold-uranium deposits in carbonaceous conglomerates of the late Archean Witwatersrand basin (South Africa). The organic geochemical molecular and isotopic data of the kerogens, bitumens and pyrolysates permit to constrain the source of the organic matter and help to understand the formation of the organic - metallic ore association. Further applications of GC/C/IRMMS approaches to understand the biogeochemical cycling of carbon, environmental pathway of pollutants, reconstruction of ancient food webs by comparing compounds in living or fossil organism, or evaluate organic components in Precambrian sediments or extraterrestrial material are all within the scope of future research and challenges for the third millennium.