Molybdenite occurrences in Greece: mineralogy, geochemistry and depositional environment

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Molybdenite occurs mainly in three mineralization types in Greece: (a) porphyry Mo-Cu-(±Te-Ag-Au), (b) reduced intrusion-related Mo-W systems (skarn, intrusion-hosted) and (c) shear zone-related Cu-Au-Bi-Mo. In porphyry-Mo-Cu prospects the molybdenite is the main ore constituent together with pyrite in quartz stockworks crosscutting sericite±carbonate altered porphyry stocks (dacite at Pagoni Rachi/Kirki, Myli/Esymi, Konos/Sapes, Melitena/Rhodopi and Stypsi/Lesvos; microgranite at Ktismata/Maronia; monzonite at Sardes/Limnos, Fakos/Limnos and Skouries/Chalkidiki). Reduced intrusion-related systems are characterized by the presence of molybdenite, pyrite and wolframite-scheelite in intrusion-hosted sheeted quartz veins and/or dissemination (granodiorite at Kimmeria/Xanthi, Plaka/Lavrion and leucogranite at Pigi/Kilkis and Seriphos) and skarn-hosted ores (Kimmeria/Xanthi). Finally in the shear-zone Stanos prospect molybdenite accompanies chalcopyrite, native Bi, Bi-tellurides and sulfosalts. The studied molybdenites display a wide spectrum of their rhenium content ranging from almost Re-free molybdenites at Stanos, to very low-Re molybdenite in the intrusion-related systems (Lavrion, Serifos, Pigia and Kimmeria), and high to ultrahigh-Re molybdenites in the northern Greek porphyries. The rare mineral rheniite (ReS_2), occurs along with Fe-Cu sulfides, Pb oxides, and native Sn in Pagoni Rachi and Konos prospects. Rheniite and high-Re molybdenite precipitated under oxidizing conditions and from relatively acid hydrothermal solutions, whereas Re-poor molybdenites are indicative of reduced conditions mostly dominant in the intrusion-related systems. At the northern Greek porphyry-Mo prospects, magmas previously enriched from their mantle source rocks were responsible for extreme contents of rhenium in molybdenite.

Sulfate redistribution in the convective clouds

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Clouds and precipitation play an important role in cycles of various tropospheric chemical species, especially sulfur and nitrogen. This is very complex problem that has to include many processes, such as cloud dynamics, microphysics and tropospheric chemistry.

In this paper, an aqueous chemistry module was incorporated into complex 3D cloud-resolving mesoscale ARPS (**A**dvanced **R**egional **P**rediction **S**ystem) model developed in the Center for analysis and prediction of storms (CAPS) at the University of Oklahoma. The goal of this paper was to examine the sensitivities of vertical redistribution of sulfate to the physical processes that take place in cloud. Six water categories were considered: water vapor, cloud water, rainwater, cloud ice, hail and snow, and five chemical species: gases H_2O_2, SO_2, O_3, and aerosols SO_4^{2-} and NH_4^+. Each chemical constituent in each microphysical category was represented by differential equation for mass continuity, so there are 30 new prognostic equations. The absorption of a gas phase chemical species in the cloud water and rainwater is calculated either by the equilibrium according to Henry's law and by real kinetic calculation of gas uptake. The source and sink terms in equations of continuity represent either transfer of a chemical species from one microphysical category to another (e. g. transfer of cloud ice sulfate to cloud water sulfate by melting, transfer of cloud water sulfate to rainwater sulfate by autoconversion etc.) or a chemical reaction (e. g. oxidation of cloud water SO_2 by H_2O_2 and O_3 to cloud water sulfate). Comprised microphysical processes in source/sink terms are: autoconversion, accretion, Bergeron processes, freezing, depositional growth, melting, sublimation and evaporation. It is assumed that initial concentrations of chemical fields fall off exponentially, from the given values of mixing ratios at the lowest model level. Two environments were simulated: continental background and moderately polluted. The cloud model is initiated by a single sounding giving the values of temperature, humidity, pressure, wind direction and velocity. The initial meteorological fields are horizontally homogeneous. The experiments were made with the real orography.

The resulting cloud model coupled with chemistry module provides a powerful diagnostic and prognostic tool for studying the relative importance of physical and chemical processes in determining the distributions of sulfate and nitrate species in convective clouds and precipitation, as well as the transport of trace chemical species within convective systems. A special emphasis was dedicated on sulfate redistribution in different water categories during the convective cloud life. Vertical profiles of sulfate following the cumulonimbus trajectory can give us a lot of information about sulfate redistribution also. The maximum values of SO_4^{2-} in the cloud water is located in the lower part of the cloud, at the place of maximum vertical wind or just a slightly behind. The same situation is with maximum values of SO_4^{2-} in cloud ice: maximum of SO_4^{2-} correspond to maximum of vertical wind.

Cretaceous lithostratigraphy in the CBGA region and some remarks to the correlation of syntectonic sedimentary successions

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The lithostratigraphy of the Cretaceous of the CBGA region is characterized by a large variety of lithostratigraphic units within individual member countries. This fact is due to the large variety of facies, especially as a consequence of Alpine orogeny, and the high number of different tectonic zones and thrust units. However, some facies types and units can be correlated over several countries, i.e. grey to whitish pelagic limestones of the Lower Cretaceous, which constitute a widespread facies within the Tethys realm, largely controlled by the paleoceanographic setting and evolutionary events.

Within pelagic limestones of the Lower Cretaceous ("Neocomian"), clastic admixtures may be present, that indicate synsedimentary tectonism related to early phases of Alpine orogeny ("eo-Alpine" phases). Clastic rocks such as huge breccia bodies and sandstones were found in a belt from Austria (Rossfeld Formation, Northern Calcareous Alps) to Slovakia (Nozdrovice Breccia, Manin Unit; Strážovce Formation, Križna Nappe) and Hungary (Lábatlan Sandstone Formation, Transdanubian Range). Most of these formations also contain chrome spinels as heavy minerals, which point to a common geotectonic position and source area type.

Mid-Cretaceous formations from the Eastern Alps and the Carpathians may be also correlated due to a common plate tectonic evolution. The Losenstein Formation (Albian-Lower Cenomanian) of the Eastern Alps marks a distinct phase of compression and thrust wedge basin evolution in the Eastern Alps. Similar deep-water conglomerates and sandstones can be found in the Western Carpathians of Slovakia, the Poruba Formation (Tatricum and Križna Nappe). Again, also the petrography of conglomerates and sandstones point to a common source area and a common geotectonic position at the northern margin of the Austroalpine microplate. Similarities to the Pieniny Klippen Belt may be discussed in the future.

A special case is formed by the Gosau Group and equivalent Gosau-type sediments within the Alps-Carpathians-Balcanides area. The term "Gosauschichten" or Gosau-type