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The role of gravity-driven flow relative to the Pyrenean orogeny in the genesis of the Cévennes « Mississippi Valley Type » ore deposits (Southern France) in Eocene time.

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Topography-driven flow is generally accepted as the most plausible mechanism for forming Mississippi Valley Type (MVT) districts worldwide. Carbonate-hosted lead-zinc ore deposits bordering the Cévennes horst in Southern France provide good examples where ancient groundwater migration controlled ore formation. Recent paleomagnetic study yielded a specified direction of remagnetization corresponding to Paleocene to Lower Eocene age. This age is relative to the uplift of the Pyrenees and argues in favor of a gravity-driven flow model. Numerical simulations of basin-scale flow are used in this study to quantify the role of topographically-driven groundwater flow in the genesis of the lead-zinc deposits.

The evolution of temperature and fluid circulations in the Cévennes margin is studied from geological reconstitutions extending across the Mesozoic foreland basins onto the adjacent Cévennes margin. Metal-bearing brines moved northward away from areas of high topographic elevation, the Pyrenean orogen or the Montagne Noire, and discharged upwards along faults in the ore location.

Considering the geochemical constraints provided by fluid inclusions study in MVT deposits, a sensitivity analysis is used to find under which range of conditions gravity-driven flow systems were capable of providing favorable fluid flow rates, temperatures and time intervals for ore formation near the southern edge of the Cévennes horst. The study concerns both permeability and geometry of the aquifer, associated with a set regional heat flow. In particular various vertical two-dimensional reconstructed sections have been tested.