Geophysical Research Abstracts
Vol. 21, EGU2019-2325, 2019
EGU General Assembly 2019

Sediment-Hosted Geothermal Systems: review and first global mapping

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Sediment-Hosted Geothermal Systems (SHGSs) are hybrid geological systems, where geothermal and sedimentary domains interact, leading to mixtures of inorganic and organic gases. Typically characterized by geothermal (thermometamorphic or mantle-derived) CO_2 and biotic (microbial or thermogenic) CH4, SHGSs occur in sedimentary basins crossed by magmatic intrusions or involved in volcanic plumbing systems. These systems can be of considerable interest for petroleum exploration and natural greenhouse-gas emission studies, but systematic studies for their characterization and worldwide distribution are missing.
Here, we provide a review of SHGSs identified so far, and propose methodological criteria for their definition and identification, based on integrated geological and gas-geochemical parameters. We find that SHGSs are typically characterized by: (a) fluids dominated by mantle or decarbonation-methamorphic CO_2 (>50 vol.%); (b) considerable amounts of CH4 and heavier hydrocarbons (at least 1.5 vol.%, generally up to 30-40 vol.%), produced by microbial or thermogenic degradation of organic matter hosted in sedimentary rocks; (c) tectonically active sedimentary basins (back-arc, rift zones and foredeep), generally hosting petroleum fields and within $\sim$300 km from recent or ancient volcanic centers. This analysis resulted in a global map including a first set of 33 SHGSs located in North America, Central and Eastern Europe, Far East, Eastern Oceania and Northern New Zealand, and a second set of potential SHGS prone areas, occurring also in South America, North Africa, Middle East and Kamchatka. The present SHGS map can evolve on the basis of more detailed geological analysis and new gas-geochemical data.