
Fault-controlled permeability: new geothermal energy potential

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Résumé

Geothermal energy is a crucial component of the green energy transition, yet its development has largely been constrained to regions with high heat flow. Through a global spatial statistical analysis of geothermal resources, we reveal that 56.2% of the world's geothermal energy production occurs in areas with thermal conditions typical of average continental crust, challenging conventional models that prioritize heat flow as the primary exploration criterion. Our findings highlight that crustal permeability - particularly fault-related permeability associated with active seismicity - is a key factor of geothermal viability, often underestimated in resource assessments. This highlights the importance of permeable structural networks in sustaining deep fluid circulation, even in regions lacking recent magmatic and tectonic activity. These findings imply that geothermal energy remains largely underutilized globally, and underscore the need to develop a new exploration strategy focused on fault-controlled permeability. This could significantly expand the role of geothermal energy in the global renewable energy landscape.

Mots-Clés: Geothermal system, Geodynamics, fault, permeability

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