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A new classification scheme for deep geothermal systems based on geologic controls

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A key element in the characterization, assessment and development of geothermal energy systems is the resource classification. Throughout the past 30 years many classifications and definitions were published mainly based on temperature and thermodynamic properties. In the past classification systems, temperature has been the essential measure of the quality of the resource and geothermal systems have been divided into three different temperature (or enthalpy) classes: low-temperature, moderate-temperature and high-temperature. There are, however, no uniform temperature ranges for these classes. It is still a key requirement of a geothermal classification that resource assessment provides logical and consistent frameworks simplified enough to communicate important aspects of geothermal energy potential to both non-experts and general public. One possible solution may be to avoid classifying geothermal resources by temperature and simply state the range of temperatures at the individual site. Due to technological development, in particular in EGS (Enhanced Geothermal Systems or Engineered Geothermal Systems; both terms are considered synonymously in this thesis) technology, currently there are more geothermal systems potentially economic than 30 years ago.
An alternative possibility is to classify geothermal energy systems by their geologic setting. Understanding and characterizing the geologic controls on geothermal systems has been an ongoing focus on different scales from plate tectonics to local tectonics/structural geology. In fact, the geologic setting has a fundamental influence on the potential temperature, on the fluid composition, the reservoir characteristics and whether the system is a predominantly convective or conductive system.
The key element in this new classification for geothermal systems is the recognition that a geothermal system is part of a geological system. The structural geological and plate tectonic setting has a fundamental influence on the characteristics of a geothermal system. The thermal regime and heat flow, hydrogeologic regime, fluid dynamics, fluid chemistry, faults and fractures, stress regime, and lithological sequence are controlled by the plate tectonic framework, hence critical for understanding the geothermal system. It is important to identify if the geothermal system is located at active plate boundaries or in intracontinental tectonically quiescent settings and thus how it relates to both active volcanism and active tectonics.