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Sommario/riassunto

Fluid flow in transforming porous rocks, fracture networks, and granular media is a very active interdisciplinary research subject in Physics, Earth Sciences, and Engineering. Examples of natural and engineered processes include hydrocarbon recovery, carbon dioxide geo-sequestration, soil drying and wetting, pollution remediation, soil liquefaction, landslides, dynamics of wet or dry granular media, dynamics of faulting or friction, volcanic eruptions, gas venting in sediments, karst development and speleogenesis, ore deposit development, and radioactive waste disposal. Hydrodynamic flow instabilities and pore scale disorder typically result in complex flow patterning. In transforming media, additional mechanisms come into play: compaction, de-compaction, erosion, segregation, and fracturing lead to changes in permeability over time. Dissolution, precipitation, and chemical reactions between solutes and solids may gradually alter the composition and structure of the solid matrix, either creating or destroying permeable paths for fluid flow. A complex, dynamic feedback thus arises where, on the one hand, the fluid flow affects the characteristics of the porous medium, and on the other hand the changing medium influences the fluid flow. This Research Topic Ebook presents current research illustrating the depth and breadth of ongoing work in the field of flow and transformation in porous media through 15 papers by 72 authors from around the world. The body of work highlights the challenges posed by the vast range of length- and time-

scales over which subsurface flow processes occur. Importantly, phenomena from each scale contribute to the larger-scale behavior. The flow of oil and gas in reservoirs, and the flow of groundwater on catchment scale is sensitively linked to pore scale processes and material heterogeneity down to the micrometer scale. The geological features of the same reservoirs and catchments evolved over millions of years, sometimes as a consequence of cracking and fracture growth occurring on the time scale of microseconds. The research presented by the authors of this Research Topic represents a step toward bridging the separation of scales as well as the separation of scientific disciplines so that a more unified picture of flow and transformation in porous media can start to emerge.