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The use of radionoble gases ^{39}Ar and ^{81}Kr in hydrological science: Accomplishments and Puzzling Inquiries

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Over the past two decades, the growing utilization of radionoble gases has significantly advanced our understanding of groundwater dynamics. These isotopes, such as ^{39}Ar ($T_{1/2}$: 269 yr) with a dating range 50-1000 yrs and ^{81}Kr ($T_{1/2}$: 229 kyr) yr for 50 - 1000 kyrs old waters, offer unique insights due to their chemical inertness. They have shed light on the timing of recharge and groundwater flow velocities in many recent studies. Despite substantial progress in analytical techniques and the exploration of new applications beyond traditional groundwater dating, persistent challenges from the past remain unresolved or have emerged anew. The presentation provides an overview of the development of the use of these tracers and an assessment of the key open questions based on 20 years of experience in this field.

The presentation also seeks to pay tribute to Reika Yokochi's († 2024) ground-breaking work. Reika stands as a pioneering scientist in this field, whose contributions have been pivotal in shaping our current understanding. Many of the studies and topics under discussion are closely connected to her innovative approach and remarkable scientific prowess.