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How could drilling change the buffering capacity of groundwater?

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Exceptionally high Ca concentrations were observed in the groundwater during the first years after drilling of groundwater wells in the Lehstenbach catchment in south-east Germany. Due to the granitic bedrock, the catchment is highly susceptible to acidifying deposition. Thus, the observed increase of Ca resulted in a considerable increase of the groundwater's buffering capacity. To study that phenomenon, Sr isotope ratios ($^{87}Sr/^{86}Sr$), major and trace element ratios were determined in water samples and by leaching of crushed drilling core samples.

Stream water samples reflected the contribution of two different groundwater endmembers, whereas a hillslope water component could not be identified. The endmembers were analysed by a principle component analysis. The first endmember could be ascribed to plagioclase and potassic feldspar, representing two of the major mineral components of the granite. The second endmember was characterised by high Ca, Mg and Sr concentrations and high $^{87}Sr/^{86}Sr$ ratios. Higher Ca/Na ratios than that of plagioclase - often considered as the major geochemical Ca source in granitic catchments - in most of the groundwater samples indicated the presence of an additional Ca source. Ca rich trace minerals like calcite or apatite are discussed in the literature to play a major role for the chemical composition of groundwater in silicate catchments, despite of the minor fraction of these minerals in the bedrock. In unweathered granite that gets exposed to groundwater, e.g., by drilling of a well, easily soluble trace minerals like calcite will likely have a much greater influence on groundwater quality than in weathered rock. Our results are in line with these findings, although some open questions remain.