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The Barzaman Formation in the UAE - an example of intensive alteration of ultramafic and mafic rocks in the near surface environment.

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The Barzaman Formation in the UAE comprises a series of matrix supported to locally clasts supported, polymict alluvial conglomerates. The Formation is widely exposed on the western edge of the Hajar Mountains that are a part of the large and well known Oman-UAE ophiolite.

The Formation was deposited as an ophiolite-derived conglomerate with a serpentinite and harzburgite matrix of sand, silt and clay grade constituents. It formed during a heavy, possibly seasonal rainfall that resulted in viscous, slurry-like, rapid mass movement, of diverse grain size that are called debris flows. The Formation is now typically strongly dolomite cemented and therefore stands proud as resistant outcrops of the alluvial fans that overlie a sequence of intensively altered ophiolite mantle rocks. There is a very distinctive lithological sequence below the contact, which comprises from the top downwards: silicified and carbonated serpentinite, carbonate-veined serpentinite and carbonate-veined partially serpentinised peridotite that passes downwards into the normal partially serpentinised peridotite. These units are the main source of the clasts for the Barzaman Formation. The most common lithology of the Barzaman Formation is poorly sorted, cobble to boulder conglomerate with clasts largely of harzburgite, serpentinite, silicified serpentinite, gabbro and a minor amount of metamorphic rocks, which are other components of the ophiolite thrust stack. They are cemented by dense, hard, weathering-resistant dolomite, which has precipitated from phreatic and locally vadose groundwater. A petrographical study using optical and scanning electron microscopy revealed that the cementation was preferential and it involved, firstly the complete replacement of the serpentinite and harzburgite sand and silt matrix and simultaneously or subsequently it strongly affected clasts. Both, physical erosion of clasts during transportation and exposure to various weathering conditions as well as extensive groundwater-rock interaction during diagenesis contributed to the presence of highly altered ophiolitic clasts. The mechanical erosion has created fractures and areas of enhanced weaknesses that were subsequently penetrated by groundwater leading to zonal and concentric dolomitization of clasts.

The partial dissolution of silicate minerals locally resulted in simultaneous precipitation of clay minerals and/or Fe oxides/hydroxides, leaving a ghost texture as evidence of the presence of former clasts. Clasts with diverse original composition show distinctively different alteration patterns. The susceptibility to dissolution and subsequent dolomitization of ultramafic and mafic clasts is suggested as follows: harzburgite and serpentinite are the most susceptible followed by gabbro with intermediate susceptibility, and silicified serpentinite as the least prone to alteration.