Upper crustal deformation associated with carbonate-rich fluid infiltration, Denali Fault system, Yukon

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The Denali Fault system, southwestern Yukon, comprises an array of fault slices bounded by the Duke River and main Denali Fault traces. Up to 400 km of displacement has been suggested along the fault system and it remains seismically active, although the major Pacific-North America plate displacements have moved outboard. Time-space analyses of earthquakes demonstrates an abrupt truncation of seismicity at about 18 km depth, consistent with a transition to ductile deformation. There is also a suggestion of initiation of seismic activity at depth with subsequent migration of events towards the surface. A dominant attribute of these rocks is the introduction of large volumes of carbonate veins in which deformation is commonly localized. Metamorphic grade in basaltic units is prehnite-pumpellyite, limiting the observed deformation to uppermost crustal conditions. An apparent paradox exists in the extensive plastic deformation, recrystallization and twin migration observed in calcite, effects commonly associated with higher metamorphic grades. These observations are part of a larger data base being assembled by several workers that questions many of the preconceptions existing about carbonate deformation and the range over which ductile deformation is operative. This is turn has implications for the activity of faults in carbonates as seals and/or conduits for fluid transport, including hydrocarbons.