



## **The Lower Cretaceous Chouf Sandstone of Lebanon: Tracking Caledonian tectonism in a Tethyan sediment**

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The Chouf Sandstone is a clastic rock sequence within the Cretaceous succession of Lebanon. Generally, the formation consists of shales, sandstones and shallow water, low-energy limestones with local volcanic horizons and lignites. The typical Chouf Sandstone is dominated by monocrystalline quartz (85-95%) indicating well-sorted sandstone deposited in fluvial to deltaic/littoral environments. The thickness of the Chouf Sandstone is variable, ranging from just a few meters to almost 700 m thick showing prominent lateral facies changes locally. Isopach maps of the Chouf Sandstone reveal systematic variations which could be interpreted as the result of deposition in extensional half-grabens at the margin of a large basin. The overlying Lower Cretaceous neritic carbonate formations do not record any major thickness variations and therefore the Chouf Sandstone may be interpreted as a Lower Cretaceous syn-rift clastic sequence.

LA-ICPMS U-Pb geochronology was conducted on detrital zircons from the Chouf Sandstone sampled along the Qartaba Anticline (Mount Lebanon). With the exception of a few Archean outliers, the resulted ages fell into three broad populations: i) a small Paleoproterozoic population, ii) a Grenvillian population, and iii) a Pan-African population (575-650 Ma). One single zircon is slightly younger than the Pan-African population, yielding a  $^{206}\text{Pb}/^{238}\text{U}$  age of  $491 \pm 5$  Ma. Zircon (U-Th)/He dating on the same samples records cooling through a nominal closure temperature of  $180^\circ\text{C}$  and yields Late Ordovician to Early Silurian ages (440-465 Ma), regressed from triplicates of zircon from seven samples across the anticline.

Typically, the youngest detrital age that is obtained by U-Pb geochronology, represents a maximum estimate for the depositional age. However, in our study the ca. 490 Ma zircon U-Pb age is interpreted as the age of primary deposition in an Early Paleozoic basin. Combined with the zircon (U-Th)/He cooling ages, our data may suggest the zircons witnessed Caledonian exhumation and subsequent deposition into a Silurian basin, which was likely a fairly rapid event because of the similarity of He ages with the youngest U-Pb age. The detrital zircons were then redeposited along with the ca. 100-120 Ma Chouf sands during Tethyan rifting of the region. These sediments were never buried sufficiently enough to reset the He systematics. Recently obtained and comparable zircon ages from a similar syn-rift Lower Cretaceous clastic sequence in the Pontides of Turkey underline the possibility of mapping out the footprint of the Caledonian orogeny extending from Europe to the Near East.