

## Overgrowths of apatite crystals on the surface of Late Ordovician conodonts from Normandy, northern France

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Recent study of new conodont collections from the Vaux Limestone exposed at its classical locality at Saint-Hilaire-la-Gérard in the Sées syncline has provided significant new information about Late Ordovician conodonts from Normandy. The abundant and low diversity conodont fauna, referred to the middle Katian-lower Hirnantian *A. ordovicicus* Zone, is closely similar to coeval faunas from other parts of continental Europe, and represents the *Sagittodontina robusta-Scabbardella altipes* biofacies of the Mediterranean Province (Ferretti et al., 2014).

The conodont specimens exhibit a CAI (Colour Alteration Index; Epstein et al., 1977) of 4-5, indicating a heating of 300-400 °C. Under the stereo microscope, elements appear moderately well-preserved. Detailed SEM investigation reveals the presence of peculiar apatite overgrowths on the oral surface of the conodont elements. Crystals are present on elements belonging to different species as well as on conodont specimens of diverse morphologies within the same apparatus.

Three types of microtexture (here defined as "large columnar", "blocky", and "web-like") have been recognized. The large columnar crystal microtexture consists of long prismatic sub-isometric apatite crystals up to 20 µm long, approximately aligned with the element main axis. A single larger crystal may fully replace the cusp. The blocky microtexture is made by up to 10 µm isometric crystals lacking a definite habit and developed close to the basal cavity and along the element margins. The blocky crystals are often unaligned, although they appear normal to the conodont surface on nodes and margins of the element. The web-like microtexture consists of tiny crystals arranged in circular rims, often bordering areas with no visible crystal pattern. The three types of crystal microtexture may develop in different areas of the same element or be exclusive of a single conodont specimen. Similar microtexture patterns have been recently described by Sanz-López & Blanco-Ferrera (2012) from middle-late Paleozoic conodonts from Spain. The surface of the conodont specimens was also analyzed by X-ray microdiffraction. Measurements were carried out on various points of the surface using a 50 µm collimator and changing specimen orientation (fixed Omega angle and varying Phi angle).

Coniform elements (*Scabbardella altipes*) reveal a polycrystalline-like structure, and no single crystal was found on the surface (i.e., the XRD spectra is a powder-like spectra). Unit cell parameters are consistent with the hexagonal symmetry of apatite. Absence or presence of identical reflections in different points measured varying Phi angles highlights the existence of a clear pattern of preferred orientations. However, the apatite crystals do not share the same type of preferred orientations along the overall surface of the conodonts, as revealed by comparison of measurements carried out in different points of the element applying the same angular parameters (Phi and Omega). This conclusion is also supported by the plot of the Beta angle intensity (i.e., different values of Beta) of the strong (3 0 0) reflection showing that the (3 0 0) intensity changes at varying  $\varphi$  angles, thus enhancing different distribution of the preferred orientations.

Ramiform elements (Pb elements of *Amorphognathus*) confirm the presence of different preferred orientations already detected in coniform specimens. Single crystals of apatite were spotted over the polycrystalline surfaces. Cell parameters of these single crystals show no significant differences with respect to polycrystalline apatites of the underlying surfaces, suggesting a syntaxial growth on the pre-existing internal apatite crystallites.

### References

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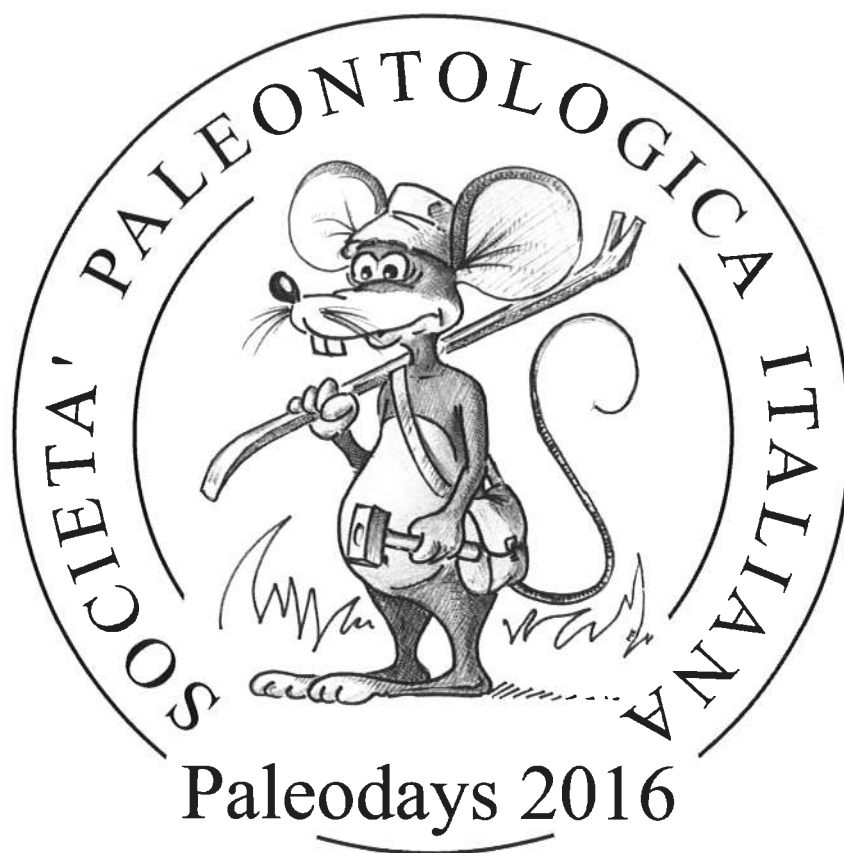
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a cura di Rook L., Bartolini S. & Ghezzi E.



*Plioverrops faventinus* TORRE 1988 dai riempimenti fine-messiniani delle fessure carsiche di Cava dei Gessi del Monticino (Brisighella). Museo Civico di Scienze Naturali "Malmerendi", Faenza

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