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# 3D models related to the publication: Patterns of bilateral asymmetry and allometry in Late Devonian *Polygnathus* conodonts

Catherine Girard<sup>1</sup>\*, Anne-Lise Charruault<sup>1</sup>, Ronan Ledevin<sup>2,3</sup>, Sabrina Renaud<sup>2</sup>

<sup>1</sup> Institut des Sciences de l'Evolution de Montpellier (ISEM), Univ Montpellier, CNRS, EPHE, IRD, Montpellier, France

<sup>2</sup>Laboratoire de Biométrie et Biologie Evolutive, UMR 5558 CNRS, Université Claude Bernard Lyon 1, Université de Lyon, 69100 Villeurbanne, France

<sup>3</sup>Current address: UMR5199 PACEA, Université de Bordeaux, Allée Geoffroy Saint Hilaire (Bat. B8), 33615 PESSAC, France

\*Corresponding author: catherine.girard@umontpellier.fr

#### Abstract

This contribution contains the 3D models of the set of Famennian conodont elements belonging to the species *Polygnathus glaber* and *Polygnathus communis* analyzed in the following publication: Renaud et al. 2021: Patterns of bilateral asymmetry and allometry in Late Devonian *Polygnathus*. Palaeontology, https://doi.org/10.1111/pala.12513.

Keywords: Conodonts, Late Devonian, Polygnathus communis, Polygnathus glaber

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Inv. Nr	Taxon	Description	UM CTB 006	Polygnathus communis	left P1 element	
<b>UM BUS 001</b>	Polygnathus glaber	right P1 element	<b>UM CTB 007</b>	Polygnathus communis	left P1 element	
<b>UM BUS 002</b>	Polygnathus glaber	right P1 element	<b>UM CTB 008</b>	Polygnathus communis	left P1 element	
<b>UM BUS 003</b>	Polygnathus glaber	right P1 element	<b>UM CTB 009</b>	Polygnathus communis	right P1 element	
<b>UM BUS 004</b>	Polygnathus glaber	left P1 element	UM CTB 010	Polygnathus communis	left P1 element	
<b>UM BUS 005</b>	Polygnathus glaber	left P1 element	<b>UM CTB 011</b>	Polygnathus communis	right P1 element	
UM BUS 006	Polygnathus glaber	right P1 element	UM CTB 012	Polygnathus communis	right P1 element	
<b>UM BUS 007</b>	Polygnathus glaber	right P1 element	<b>UM CTB 013</b>	Polygnathus communis	right P1 element	
<b>UM BUS 008</b>	Polygnathus glaber	left P1 element	UM CTB 014	Polygnathus communis	right P1 element	
<b>UM BUS 009</b>	Polygnathus glaber	left P1 element	<b>UM CTB 015</b>	Polygnathus communis	right P1 element	
<b>UM BUS 010</b>	Polygnathus glaber	right P1 element	UM CTB 016	Polygnathus communis	left P1 element	
<b>UM BUS 011</b>	Polygnathus glaber	right P1 element	<b>UM CTB 017</b>	Polygnathus communis	right P1 element	
<b>UM BUS 012</b>	Polygnathus glaber	right P1 element	UM CTB 018	Polygnathus communis	right P1 element	
<b>UM BUS 013</b>	Polygnathus glaber	left P1 element	<b>UM CTB 019</b>	Polygnathus communis	right P1 element	
UM BUS 014	Polygnathus glaber	left P1 element	UM CTB 020	Polygnathus communis	right P1 element	
UM BUS 015	Polygnathus glaber	left P1 element	<b>UM CTB 021</b>	Polygnathus communis	left P1 element	
UM BUS 016	Polygnathus glaber	right P1 element	UM CTB 022	Polygnathus communis	left element	
<b>UM BUS 017</b>	Polygnathus glaber	left P1 element	UM CTB 023	Polygnathus communis	left P1 element	
UM BUS 018	Polygnathus glaber	left P1 element	UM CTB 024	Polygnathus communis	left P1 element	
<b>UM BUS 019</b>	Polygnathus glaber	left P1 element	<b>UM CTB 025</b>	Polygnathus communis	left P1 element	
<b>UM BUS 020</b>	Polygnathus glaber	left P1 element	UM CTB 026	Polygnathus communis	left P1 element	
<b>UM BUS 021</b>	Polygnathus glaber	right P1 element	<b>UM CTB 027</b>	Polygnathus communis	left P1 element	
UM BUS 022	Polygnathus glaber	left P1 element	UM CTB 028	Polygnathus communis	left P1 element	
<b>UM BUS 023</b>	Polygnathus glaber	left P1 element	UM CTB 029	Polygnathus communis	left P1 element	
UM BUS 024	Polygnathus glaber	left P1 element	UM CTB 030	Polygnathus communis	left P1 element	
UM BUS 025	Polygnathus glaber	left P1 element	UM CTB 031	Polygnathus communis	left P1 element	
UM BUS 026	Polygnathus glaber	left P1 element	UM CTB 032	Polygnathus communis	left P1 element	
<b>UM BUS 027</b>	Polygnathus glaber	right P1 element	UM CTB 033	Polygnathus communis	left P1 element	
<b>UM BUS 028</b>	Polygnathus glaber	right P1 element	UM CTB 034	Polygnathus communis	right P1 element	
UM BUS 029	Polygnathus glaber	right P1 element	<b>Table 1.</b> 3D models of Polygnathus glaber and of Polygnathus com-			
UM BUS 030	Polygnathus glaber	right P1 element	munis. Collection: University of Montpellier, France.			
UM CTB 001	Polygnathus communis	right P1 element		INTRODUCTION		
UM CTB 002	Polygnathus communis	right P1 element	INTRODUCTION			
UM CTB 003	Polygnathus communis	right P1 element	This contribution	This contribution presents 3D models of 64 Famennien (Late		
UM CTB 004	Polygnathus communis	right P1 element	Devonian) conodont elements belonging to two Polygnathus			
UM CTB 005	Polygnathus communis	left P1 element	species (see Table 1 and Fig. 1). All elements correspond			

The 3D surface of these elements were used in a geometric morphometric analysis complementing an extensive 2D quantitative study (Renaud et al. 2021). Based on a set of sliding semi-landmarks located at the edge of the platform and on the carina, this study aimed at disentangling the different components of the morphological variation in Late Devonian Polygnathus P1 elements. The 3D morphometric analysis improved the description of the geometric changes involved in growth and bilateral asymmetry and provided evidence that the balance between the two components of shape variance varies across species. Allometry was most pronounced in Polygnathus communis, leading from small, heart-shaped to large, lanceolate platforms. In contrast, bilateral asymmetry was most pronounced in Po. glaber, suggestive in this species of a strict directional asymmetry. On the mean shape of left elements, the posterior margin extended more ventrally, the posterior platform was more elevated and displayed a shallower groove, as confirmed by the example of actual elements (Fig. 1). The reverse is true for the right element, with, however, less offset between the ventral extension of the posterior and anterior margins. Knowing that the left blade is assumed to insert behind the right one, based on existing clusters (Donoghue and Purnell 1999; Martínez-Pérez et al. 2016), the geometric differences between right and left elements, evidenced on the 3D models, could be associated with the asymmetrical pairing of the elements during occlusion.

#### **METHODS**

Digitization of the specimens was performed using an X-ray microtomograph ( $\mu$ CT) Phoenix nanotomeS on the AniRA-Immos platform of the SFR Biosciences (UMS 3444, ENS Lyon) at a cubic voxel resolution of 1  $\mu$ m. The scanning parameters were as follow: 100 kV, 70  $\mu$ A, 3000 projections at 360° with no filter. The 3D surfaces were extracted semi-automatically within AVIZO 9 (Thermofisher Scientific) using the segmentation threshold selection tool. The 3D surfaces are provided in .ply format, and can therefore be opened with a wide range of freeware.

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**Figure 1.** Illustrations based on isolated right and left elements of *Po. glaber* (A), large *Po. communis* (B) and small *Po. communis* (C). (A, B, C) left element to the left and right element to the right. Top panels, oral view; bottom panels, profile view. The position of the slice corresponding to the profile view is marked by a line on the oral view. Elements not to scale. Specimens figured: (A) *Po. glaber* right (UM BUS 027) and left (UM BUS 026); (B) large *Po. communis* left (UM CTB 010) and right (UM CTB 009); (C) small *Po. communis* left (UM CTB 006) and right (UM CTB 003).