

## MATERIAL AND METHODS

All figured specimens from San Juan Province are housed in the paleontological repository of the Centro de Investigaciones Paleobiológicas (CIPAL), at Universidad Nacional de Córdoba, Córdoba, prefixed CEGH-UNC. Those from La Rioja Province are housed in the repository of the Museo de Paleontología at Universidad Nacional de La Rioja, La Rioja, prefixed PULR. Specimens were prepared with fine needles, and percussion pneumatic scribe under high magnification using Leica MZ6 and, when necessary, repaired using cyanoacrylate glue. Preparation for photography consisted in staining with matte black tincture, and coating with sublimate of ammonium chloride. Photographs were taken with Cannon Power Shot 50 digital camera, fitted to a Leica MZ75. Digital photographs were processed in Adobe Photoshop CS3.

## SUPPLEMENTARY DISCUSSIONS

The recognition of infaunal moulting in phacopid trilobites confirms predictions of Eldredge (1970), based on observations of the horseshoe crab, a reasonably analog living arthropod. Functional morphology data such as poral canals for tactile setae insertion (to monitoring burial conditions), and the cephalic anterior arch, among other morphological features recognized in *Paciphacops*, could be interpreted as facilitating the infaunal activity. Eldredge's (1970) exhaustive descriptions of the horseshoe self-burial traits, provide insights on the most probable excavation mechanism performed by trilobites in soft sediments, arguing against other views that consider that big eyes and a globose (swollen) glabella impede infaunalism. Physiological comparisons with living arthropods, mainly related to breathing efficiency considering the trilobite being buried (even taking into account different sedimentary conditions), are not presently understood and are important issues for future investigations.

An interesting taphonomic aspect is the fact that the infaunal behavior for moulting, described here, could be recognized mainly from direct interpretations based on the striking pattern of body fossils. In the absence of this "positive evidence", the record and interpretation of this kind of behavior becomes less easy to decipher. Probably, other moult assemblages among trilobites, bidimensionally arranged in hydrodynamically stable orientations, might have been infaunally generated, yet they are overall interpreted either as originated by sudden burial or under very quiet sea bottom conditions of low oxygenation together with absence of bioturbators/scavengers. Additionally, interpretations are complicated by the fact that the infaunal mode for moulting seems to be facultative. This taphonomic dilemma suggests that infaunalism, particularly for moulting, could be really common among trilobites, but underestimated. These difficulties have already been noted by Benton (2010), as typical of the behavioral paleontological record in general. Modes of preservation analogous to that exhibited by *Paciphacops*, could help to elucidate which trilobites were infaunal moulters when indirect evidences (e.g. taphonomical from other associated groups, sedimentological, from functional anatomy, etc.) are suggestive but inconclusive.

## SUPPLEMENTARY FIGURE CAPTIONS

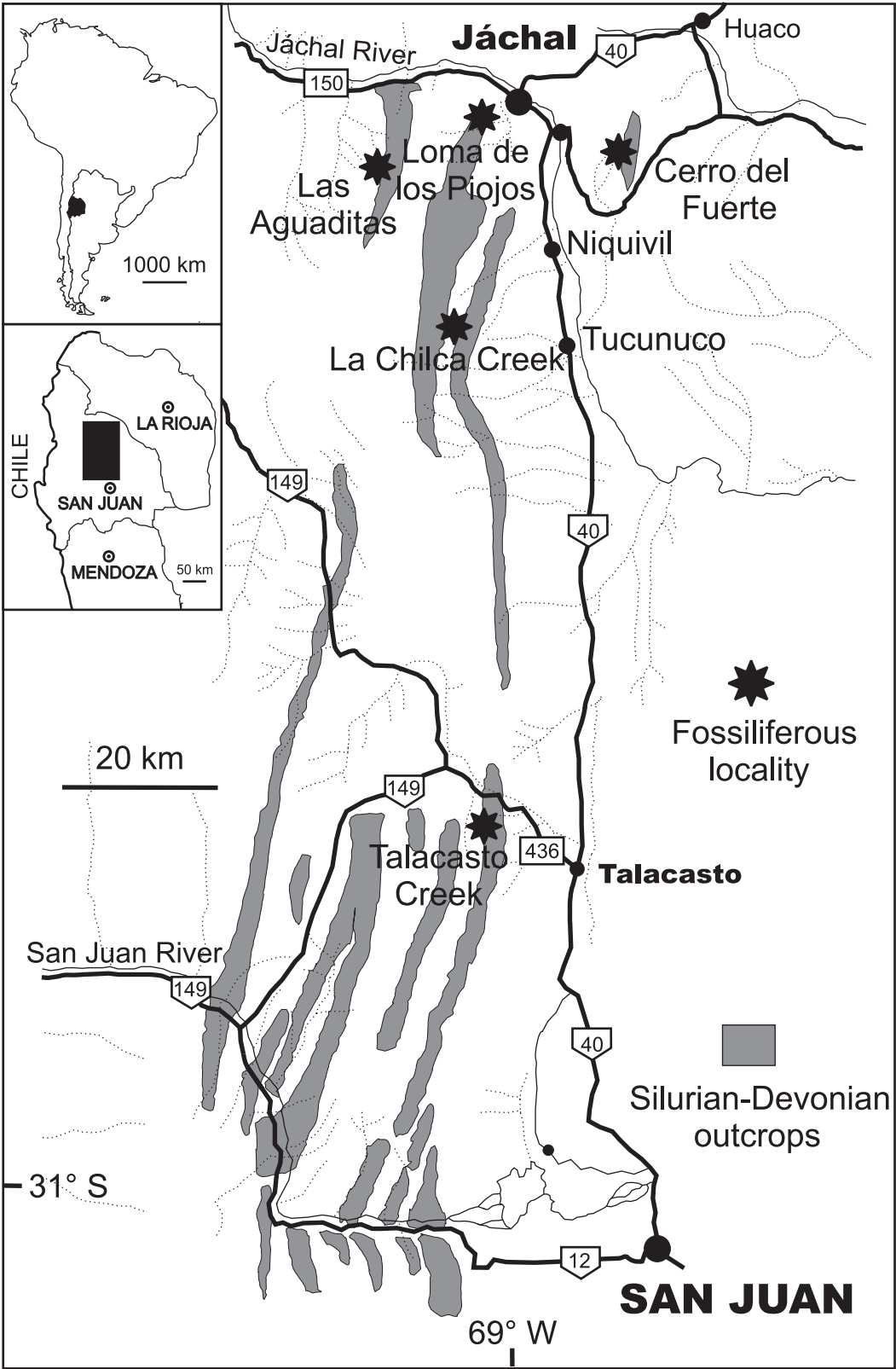
Figure DR1. Location map showing Silurian-Devonian outcrops of the Los Espejos Formation and Talacasto Formation, and main fossiliferous localities in the San Juan Province. All three *Paciphacops* species are recorded in this area of the Precordillera basin.

Figure DR2. Location map showing a fossiliferous locality of *Paciphacops* (*Paciphacops*) n. sp. B in the Sierra de las Minitas, La Rioja Province, Argentina (modified from Coughlin, 2000). This locality is separated from those of San Juan Province, to the south (See Fig. 1 and Fig. DR1), by about 200km.

Figure DR3. Infaunal moult ensembles of *Paciphacops*. (A-F) *Paciphacops* (*Paciphacops*) *argentinus* (Thomas, 1906), from the upper part of the Los Espejos Formation, Upper Silurian (Ludlow), San Juan Province. (A-D) CEGH-UNC 24.078, almost complete specimen, Loma de los Piojos section. (A) posterodorsal view, (B) lateral view, (C) dorsal view, (D) close-up showing the cephalon almost vertically oriented, perpendicular and in a higher position with respect to the thorax, (E) CEGH-UNC 24.080, almost complete specimen, dorsolateral view, La Chilca section, (F) the same specimen, dorsal view, note the absence of spines, (G-J) *Paciphacops* (*Paciphacops*) n. sp. A, from the basal part of the Talacasto Formation, lower Lochkovian, Poblete Sur Creek, San Juan, province. (G) CEGH-UNC 10.510, almost complete specimen, internal mould of thoracopygidium and attached latex mould of the cephalon, lateral view, note the lack of spines, and bigger size. (H) anterolateral view of the cephalon showing the prominent spiny occipital node (n), a diagnostic character of the new species, latex mould, (I) frontal view of the same cephalon showing the relative position of the eye and occipital spiny node (n), (J) the same specimen, dorsal view. Scale bar: 5mm.

Figure DR4. Infaunal moult ensembles of *Paciphacops*. (A-I) *Paciphacops* (*Paciphacops*) n. sp. B, Lower part of the Talacasto Formation, upper Lochkovian, all except (C) from Las Aguaditas Creek, San Juan Province. (A) CEGH-UNC 24.089, ventral view showing the relative position of the hypostome (h), (B) the same specimen in dorsal view showing an articulated thorax (t), and the external mould of the occipital ring isolated anteriorly (viewed as a conic hole into the sedimentary matrix) indicating the up-right position of cephalon (c), which defines a three-dimensional arrangement of the moult elements. (C) PULR 118, almost complete specimen, dorsolateral view, Sierra de las Minitas, Talacasto Formation, La Rioja Province. (D) CEGH-UNC 24.081 (latex cast), enlargement showing the relative positions of cephalon and thorax: the occipital ring lies perpendicularly over the first thoracic segment, (E) complete specimen in lateral view note the spines and biggest size, (F) posterodorsal view, (G) the same specimen in dorsal view. (H), CEGH-UNC 24.084, posterolateral dorsal view. (I) CEGH-UNC 24.083, posterolateral dorsal view. Scale bar 5 mm.

Movie DR 1. This movie shows a reconstruction of a Late Silurian-Early Devonian environment (during early stages of the Mid Paleozoic Marine Revolution). The infaunal behavior of *Paciphacops*, as observed exclusively for moulting, is interpreted to be an strategy to avoid predators (in this case fishes and orthoconic nautiloids). The movie shows in detail how the initial burrowing in soft sediments could be performed by the trilobite, and then the complete process of underground exuviation that generates the moult pattern described in this work.



# Stratigraphic references

## UPPER PALEOZOIC

- Mulas Muertas Fm
- Río del Peñón Fm
- Punta del Agua Fm
- Cerro Tres Cóndores Fm
- Agua de Lucho Fm

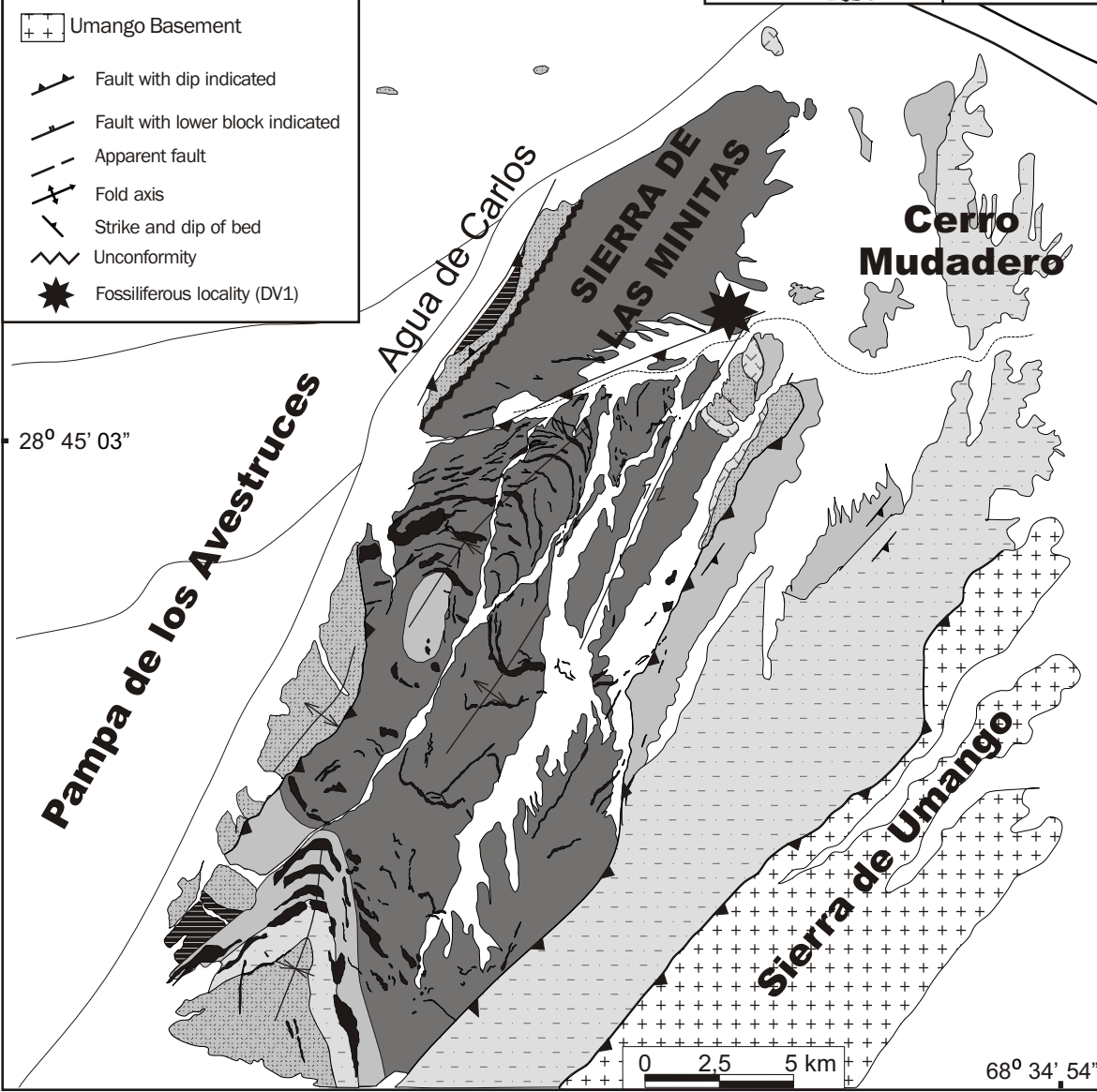
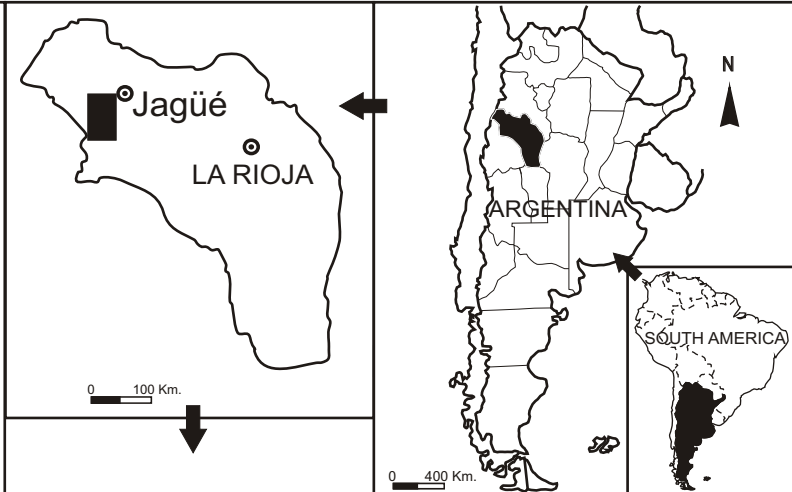
## LOWER PALEOZOIC

- Devonian- Mississippian dykes
- Devonian (partially Lower Devonian Talacasto Formation)

## MESOPROTEROZOIC

- Umango Basement

- Fault with dip indicated
- Fault with lower block indicated
- Apparent fault
- Fold axis
- Strike and dip of bed
- Unconformity
- Fossiliferous locality (DV1)

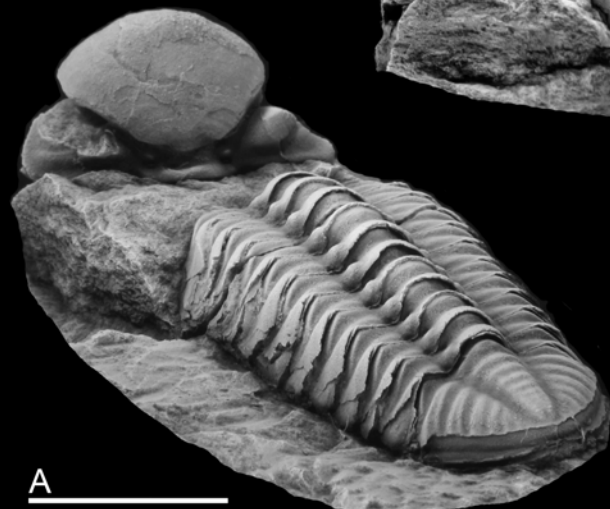




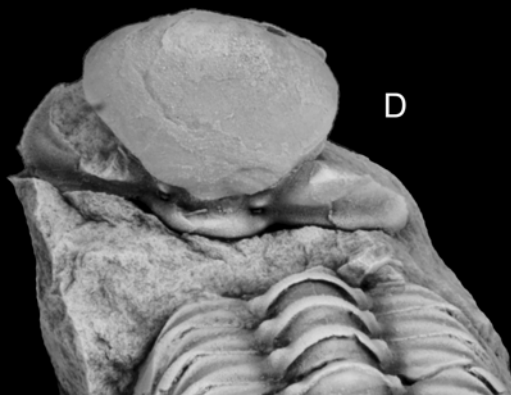
B



C



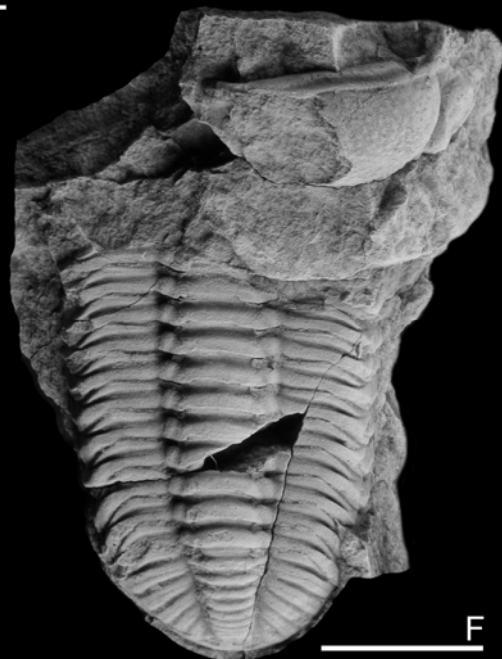
A



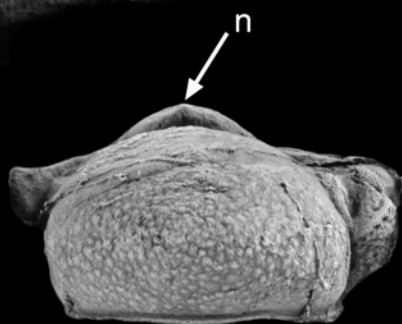
D



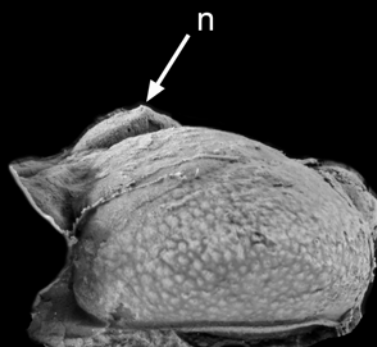
E



F



H



I



G



J

