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## Three-dimensional *Cloudina* specimens extraction from limestone of the Nama Group, Namibia

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The traditional study of *Cloudina lucianoï* and *Cloudina riemkeae* and other tubular calcareous fossils hosted in limestone are performed preferably in two-dimensional (2D) views. For these analyses is used polish or thin sections due to the ease of this methodology and quick preparation. Although, to study three-dimensional (3D) specimens in 2D views is difficult to accurate and reconstruct the 3D morphology of these fossils. In some cases, phosphatization offers an opportunity to know more about its morphology because the fossil can be easily isolated from the rock matrix by acid attack without destroying the specimen [1]. In contrast, when the composition of the fossil and the matrix are both carbonaceous, it becomes a challenge to separate the specimen from the rock. This work shows a new methodology of separating the specimen using a very weak acid such as vinegar, with contains a low concentration of acetic acid (4% acetic acid).

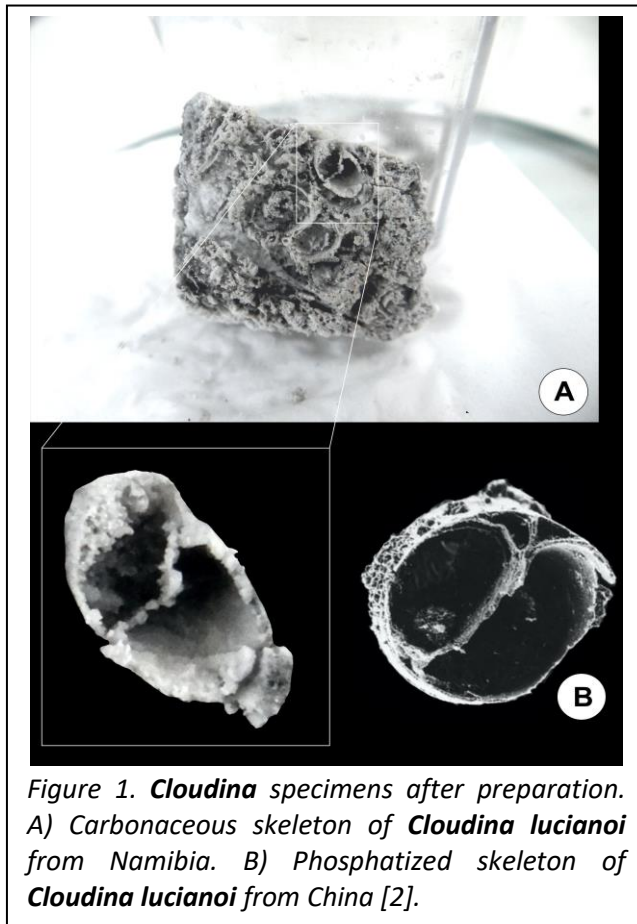


Figure 1. *Cloudina* specimens after preparation. A) Carbonaceous skeleton of *Cloudina lucianoï* from Namibia. B) Phosphatized skeleton of *Cloudina lucianoï* from China [2].

The methodology consists of selecting a fossiliferous sample and introducing an acid acetic solution 4%. As the shell composition varies slightly from the matrix's, it allows the acid to act differently, releasing the tubes following the reaction:  $\text{CaCO}_{3(s)} + 2 \text{CH}_3\text{COOH}_{(aq)} \rightarrow \text{Ca}(\text{CH}_3\text{-COO})_{2(aq)} + \text{H}_2\text{O}_{(l)} + \text{CO}_{2(g)}$ . A similar process, but slower, occurs in the outcrops of these calcareous fossiliferous rocks, where the carbonic acid ( $\text{H}_2\text{CO}_3$ ) of the rain erodes the matrix resulting in the exposition of the tubes. In the laboratory the reaction can be controlled daily by the observation of the acid's action on the fossils. The full preparation cycle takes about 15 to 20 days. The acid must be replaced every three days. At the end of the preparation, the sample must be thoroughly washed with running water for about 5 minutes.

All studied samples came from Nama Group in Namibia, have shown efficient results where *Cloudina* skeleton can be studied in 3D views. This preparation shows similar results when compared to that obtained by phosphatized skeleton preparations from Dengying Formation

in China [2]. This easy, accessible and environmental friendly method presented herein might be used by researchers to conduct 3D studies with carbonaceous fossils in limestone rocks.

*References:*

[1] Hua H *et al.*, (2003) *Palaios*, 18:454–459.

[2] Hua H *et al.*, (2005) *Geology*, 33(4):277-280.

