Contributions to Zoology, 72 (2-3) 141-145 (2003)
SPB Academic Publishing bv, The Hague

A new preparatory approach of decapod and thoracican crustaceans from the Middle Danian at Fakse, Denmark

Sten Lennart Jakobsen
Geological Museum, University of Copenhagen, Øster Voldgade 5-7, DK-1350 Copenhagen K, Denmark

Keywords: Preparation, Crustacea, Danian, Denmark

Abstract

Many papers on the taxonomy of fossil crustaceans are often based upon poorly preserved material and/or specimens that have been insufficiently prepared. The purpose of the present note is to outline some preparation methods that are applied in our (J.S.H. Collins and S.L.J.) ongoing studies of anomuran and brachyuran decapods from the Middle Danian limestones at Fakse quarry (Denmark), which have greatly enhanced the quality of our material. The techniques briefly outlined here involve: 1 – **staining method;** 2 – **water blasting** (as a cleaning tool in preparation of fossils); and 3 – **negative preparation** (with acid). Some of these techniques will have wide applications in other fields of paleontological research.

Introduction

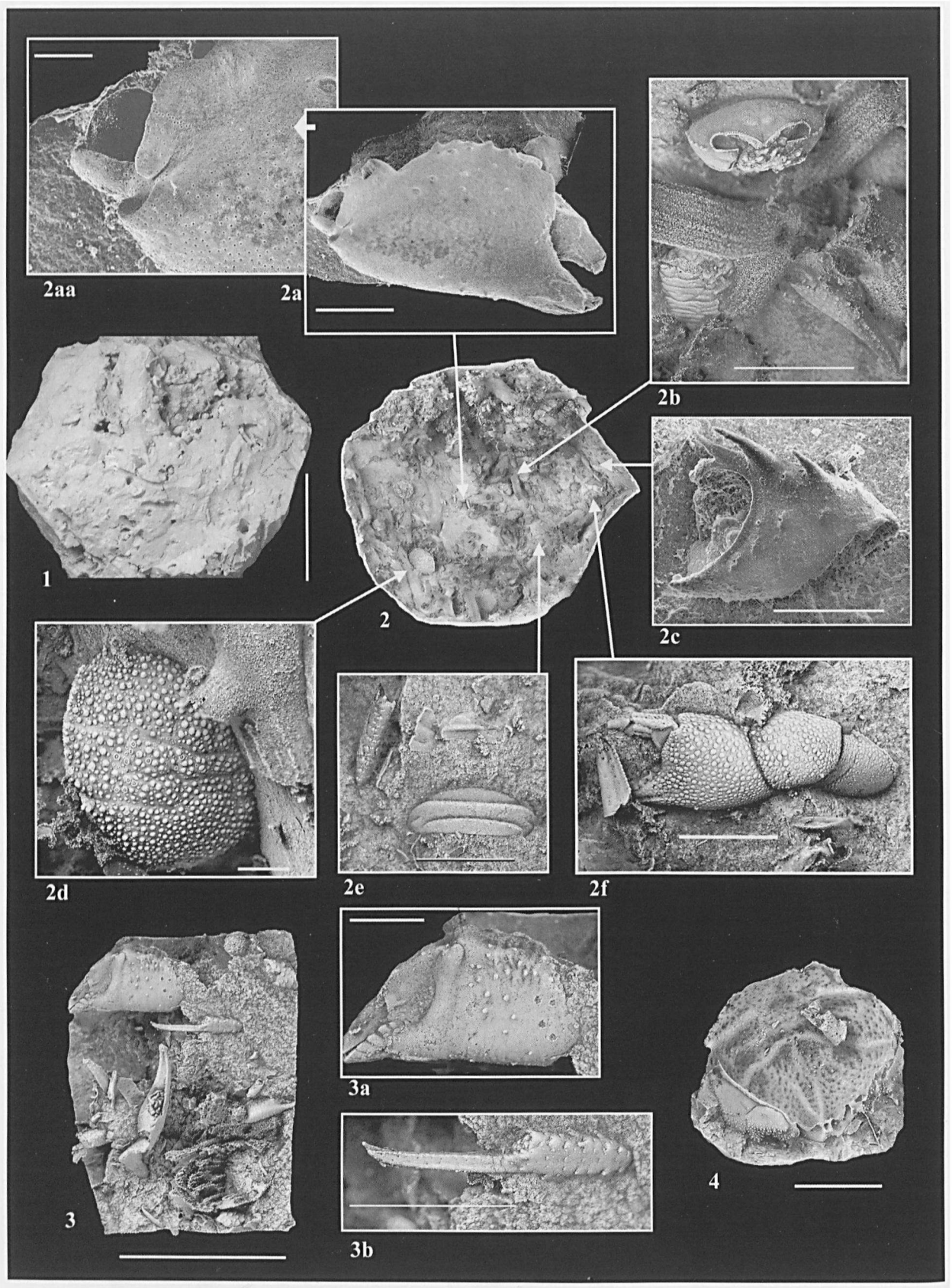
Fakse quarry is situated east of the village of Fakse (Sjaelland, Denmark), and together with the nearby Stevns Klint cliff section, constitutes the type locality of the Danian Stage, i.e., the lowermost stage of the Paleogene. A section is exposed at Fakse quarry through a bryozoan-coral mound complex of Middle Danian age (*Tylocidaris bruennichi* echinoid Zone; NP3 nannoplankton zone). The carbonate sequence there is highly fossiliferous, and fauna and lithofacies have been described by numerous authors. Of note is the abundant presence of some 20 species of anomuran and brachyuran decapods.

The limestone comprises two major facies (bryozoan and coral limestone) in a wide range of subfacies, due to depositional differences and local variation in diagenesis. The crab material consists entirely of disintegrated (portions of) molts, preserved as external and internal moulds (steinkerns), with the original cuticle converted into a structureless, whitish mass covering the surface. Only when found in cavities do the crab remains often expose a thin layer of early diagenetic calcite cement displaying the original surface. Remarkably, there is no evidence of corpses amongst the crab assemblages at Fakse, apart from two specimens of the brachyuran *Raniliformis* and two undescribed macrurans. The numerous remains found often exhibit pre-fossil fragmentation, probably as a result of high-energy palaeoconditions.

A – Negative preparation and acid treatment

Preparation of material from Fakse has traditionally involved either, 1 – a cleaning process where the surrounding matrix was removed, or 2 – the removal of the internal mould (= so-called negative preparation), leaving an external mould from which a cast can be produced. The first step in preparation is to consider the right choice of method. A partially exposed internal mold selected for staining purposes may be cleaned using mechanical tools such as pneumatic air scribes (Desoutter PowerPen and air scribe W 224). To roughly expose the internal mould of a carapace, the Desoutter PowerPen is recommended as it quickly removes thicker portions of the surrounding matrix. The air scribe W 224 is better adapted for gentle removal of matrix near intricate carapace parts such as rostrum and orbits.

In those cases where the limestone contains numerous crab remains, exposed either by hammer and chisel or by using hydraulic pressure, a negative preparation has proved to be the most conve-


2aa
2a
2b
1
2
2c
2d
2e
2f
3a
3
3b
4

nient, fastest and profitable treatment (Fig. 1,1-4). By using the air scribe W 224, most of the enclosed crab remains were roughly chiseled away and then cleaned by high pressured water from a water gun (W 400 SE). The gun generates a fine, highly powered jet stream of water (adjustable up to 180 bar) that blows off most of the particles in the imprint immediately without harming the surface details. In such cases where pieces of internal mold remain in the imprint, an Ultra Sonic Scaler used in the dental profession to remove hard calculus and stains from the teeth painstakingly removed these. As the water rinse used in the dental office to clean the gum line of loosened debris is not favorable in some fossils, the water supply can simply be disconnected. The cleaning should be done under stereomicroscope to allow for controllable cleaning of the details in order to avoid damage to the surface of the external mould. When cleaned, the prepared limestone were cast either with latex rubber (black tone color incorporated) or silicone rubber (Wacker silicone 4400 or Silastic 9161).

For rapid examination of the external mould, a fast-setting vinyl polyxilosane impression material such as Exaflex Putty may be used. Exaflex Putty is a dental product composed of a base and a catalyst component, which when thoroughly mixed, applied to the imprints and allowed to set for a couple of minutes, can be removed from the external mould. The casting result is surprisingly good even with rather complex negative imprints. In limestone, however, with imprints of very complex nature, a vacuum-impregnated silicone rubber cast was made. After polymerization (24 hours), the surrounding matrix was removed completely by soaking in a bath of 10 % hydrochloric acid for a couple of hours. The acid-prepared specimen offers excellent study material and often reveals unexpected encrustations that are not normally 'captured' in latex casts or Exaflex impression compound. When choosing a negative preparation procedure, this method may reduce the preparation time to a fraction of that accomplished by other methods – with an even better result.

B – Staining internal moulds of carapaces in search for epibionts

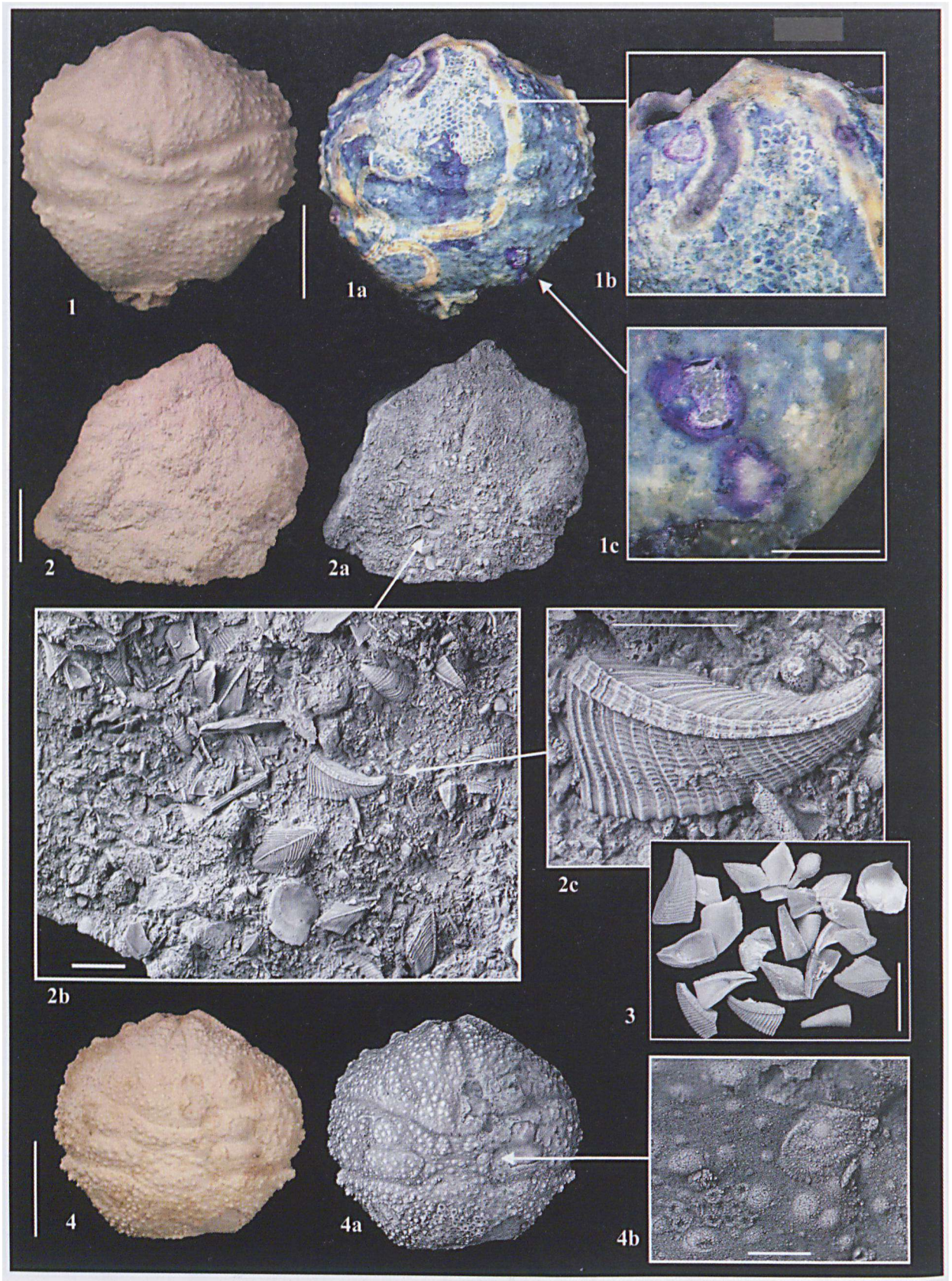
Staining methods have widely been used to facilitate rapid identification of certain minerals in carbonate rock material, but, as far as I know, not yet for identification of encrusting fossils in limestone. The introduction of the staining technique in order to examine encrusting epibionts inside carapaces of *Dromiopsis rugosa* (Schlotheim) has revealed surprising results. Treatment of the internal mold of carapaces with methylene blue as a staining agent provides now information on obscured encrusting epibionts (Fig. 2,1). Before staining the external mould, the remaining structureless cuticular layer has to be removed by gently sandblasting the surface, preferably by using acrylic powder as blasting medium.

The step-by-step procedure with use of methylene blue is as follows:

1. The specimen (steinkern) must be completely dry prior to staining for improved penetration of the dye;
2. Prepare a solution of methylene blue. May be diluted 1 to 3 parts of distilled water;
3. The dried specimen is now placed in the solu-

←

Fig 1. 1, A slab of coral limestone from Fakse with numerous remains of decapods preserved as voids in the limestone (scale bar equals 50 mm). 2, Acid-prepared silicone rubber cast of the same specimen as in 1-1. The limestone has been cleaned by water blasting prior to casting. 2a, SEM image of a well-preserved chela of a juvenile *Dromiopsis elegans* (scale bar equals 1 mm); 2aa, SEM image of the same specimen, showing details of the posterior portion of the palm (scale bar equals 200mm); 2b, Close-up showing frontal region of a juvenile *D. elegans*, a carapace (lower left) and a right chela of a galatheid (scale bar equals 5 mm); 2c, SEM image of a carpus, presumably assignable to *Galathea* (scale bar equals 1 mm); 2d, Left-hand portion of a carapace of *Dromiopsis rugosa* (scale bar equals 2 mm); 2e, Abdominal segment of an anomuran decapod, possibly a galatheid (right) and a merus of an unidentified anomuran (left) (scale bar equals 2 mm); 2f, Left cheliped of *Caloxanthus ornata* (scale bar equals 2 mm). 3, Acid-prepared silicone rubber cast of a crustacean assemblage showing isolated chelae of *Galathea, Dromiopsis* and *Munida* or *Protomunida* (scale bar equals 10 mm); 3a, Left chela of *Dromiopsis elegans* (scale bar equals 2 mm); 3b, Left chela of *Munida* or *Protomunida* (scale bar equals 3 mm). 4, Acid-prepared silicone rubber cast of an isolated caparace of *Dromiopsis rugosa*, showing the internal aspect (scale bar equals 10 mm).


1
1a
1b
1c
2
2a
2b
2c
3
4
4a
4b

tion for approx. 10 seconds. The penetration of the solution depends largely upon texture and porosity of the specimens and rate of diffusion of dye solution. The staining clearly differentiates the obscure encrusting bryozoans, serpulids and brachiopods attached to the inside of the carapace;

4. Then the specimen is removed from the color bath, shortly cleaned with tap water and left to dry in an oven (100 degrees) for one hour;
5. For greater intensity of the staining it is recommendable to apply few drops of light machine oil;
6. After the oil has soaked into the rock, the specimen is placed in a water bath added with photographic agent in order to avoid air bubbles adhering to the surface of the specimen prior to photographing;
7. Digital images can be made and processed in a computer program such as Adobe Photoshop.

C – Waterblasting method

High-pressure water, known as water blasting or wet blasting, is a common industrial procedure for removing deposits such as paint and rust from various kinds of surface materials. With this procedure, the water creates an abrasive spray which is as effective as sandblasting. By using an ordinary pressure washer (model Gerni compact) with adjustable water pressure up to 150 bar, bulk samples of cirripede-bearing bryozoan limestone were cleaned rapidly with outstanding results (Fig. 2,2). A prolonged cleaning of the samples will even result in a complete disintegration of the limestone, so the various fossil remains can be extracted for study without any traces of abrasion (Fig. 2,3).

Although the method is superior to sandblasting techniques, the water blasting method has escaped attention of most fossil preparators. Explore your creativity and you will find further applications in fossil preparation.

D – Photography

In order to create a uniform photographic appearance, the material was blackened either with black ink airbrushed to the actual fossils or by using dry color powder dusted to the silicone rubber cast with excessive powder blown away by compressed air, which creates a fine black coating. The ink applied to the fossil specimens was removed by soaking the specimens in a bath of ordinary household bleaching agent for a couple of minutes and then washed in water. The pre-treatment makes for a superb background color prior to a light coating with sublimated ammonium chloride which further enhances the contrast in the final images (Fig. 2,4).

Acknowledgements

Special thanks to Dr Jan Kresten Nielsen for critical reading of an earlier typescript and for providing SEM photographs.

Received: 31 March 2003

←

Fig. 2. 1, Internal mold (steinkern) of a carapace of an adult specimen of *Dromiopsis rugosa* (scale bar equals 10 mm); 1a, Same specimen stained with methylene blue, clearly demonstrating the presence of epibionts (calcitic serpulids, cheilostomate bryozoans and brachiopods) attached to the inside of carapace (scale bar equals 10 mm); 1b, Close-up of the anterior portion of the carapace, showing details of the serpulid attachment, bryozoans and a single brachiopod, ?*Thecidellina*; 1c, Close-up of the posterior portion of the carapace, showing two specimens of brachiopods, ?*Thecidellina* (scale bar equals 2 mm). 2, Unprepared slab of bryozoan limestone containing plates of pedunculate cirripedes, isolated spines of regular echinoids, remains of crinoids (*Cyathidium holopus*) and small oysters (scale bar equals 50 mm); 2a, Same slab cleaned with water blasting (for approx. 15 seconds), revealing numerous plates of cirripedes (*Pycnolepas bruennichi*); 2b, Close-up image showing extraordinary abundance of cirripede plates, all presumably belonging to the same species (*P. bruennichi*) (scale bar equals 10 mm); 2c, Detailed image of a single scutum (*P. bruennichi*), illustrating the advantages of the cleaning technique (scale bar equals 5 mm). 3, Isolated plates of cirripedes extracted from the limestone by prolonged treatment with waterblasting (scale bar equals 10 mm). 4, Invisible epibionts (bryozoans, brachiopod) on a carapace of *Dromiopsis rugosa* with surface ornament (scale bar equals 10 mm); 4a, Same specimen blackened with ink (airbrushed) prior to application of sublimated ammonium chloride, revealing bryozoan encrustation (posterior portion of carapace) and a firmly attached, small brachiopod ?*Thecidellina* in the branchio-cardiac region (scale bar equals 10 mm); 4b, Close-up of the brachiopod (scale bar equals 1 mm).