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COMPUTER-AIDED RESTORATION–RECONSTRUCTION OF TRILOBITES (CARROT)

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ABSTRACT

Trilobites were bilaterally symmetrical organisms. Computerized images of incomplete, undeformed specimens can therefore be reflected across their axes of symmetry to obtain complete representations. Furthermore, images of structurally deformed trilobites can be manipulated to reduce and/or remove the distortion. The acronym CARROT is proposed for the Computer-Aided Restoration–Reconstruction Of Trilobites.

INTRODUCTION

The reconstruction of fossil specimens is an important part of systematic paleontology. In the past, this has largely been done manually, using pen and tracing paper or camera lucida equipment. The advent of computers offers potential for reduction of some of the tedium traditionally associated with this process.

Like many other fossils, trilobites were bilaterally symmetrical organisms. Computerized images of incomplete, undeformed specimens can therefore be reflected across their axes of symmetry to obtain complete replicas (Figures 1 to 4).

Structurally deformed trilobites are more difficult to reconstruct because they are asymmetrical (Figures 5a and 6a). Computerized images of trilobites deformed by simple shear require the application of a reverse simple shear to counteract the original tectonic distortion (Figures 5b and 6b). If the distortion is completely removed, the image may then be reflected across its axis of symmetry to produce a complete replica (Figure 6c).

METHODS AND EQUIPMENT

Existing trilobite line drawings and photographs were scanned at 400 dpi (dots per inch) using a Migraph Hand Scanner. The scanner was controlled by Touch-Up version 1.53 (also from Migraph), running on a 2 Megabyte Atari Mega ST2 computer.

Undeformed trilobite images were reflected around their axes of symmetry by drawing a clip box around the more complete halves and then selecting Touch-Up's 'Mirror Left' or 'Mirror Right' commands. Touch-Up's 'Slant Vertical' and 'Slant Horizontal' commands were used to remove the distortion from deformed trilobite images; the 'Mirror' commands were then used on the restored images. All trilobite images were saved directly in MS-DOS .PCX or .TIF format on a 3.5 inch 720K MS-DOS compatible ST disk.

The image files were subsequently loaded directly from the ST disk into a 4 Megabyte Hewlett-Packard RS/20C Vectra, running Hewlett-Packard's Corel Draw version 1.1. The images were then printed using a 180 x 180 dpi Hewlett-Packard Paint Jet printer.

UNDEFORMED TRILOBITE EXAMPLES

Leiostegium proprium Boyce, 1989, *Peltabellia* sp. cf. *P. peltabella* (Ross, 1951) and *Strigigenalis brevicaudata* Boyce, 1989, were recently illustrated by the author from the St. George Group of western Newfoundland (Boyce, 1989). Figures 1a to 4a were obtained by scanning the original photographs of these species. Figures 1b to 4b were produced by reflecting the more complete side of each specimen across its axis of symmetry.

DEFORMED TRILOBITE EXAMPLES

Acadoparadoxides regina (Matthew, 1888) is a well known Middle Cambrian Acado-Baltic trilobite. It was first described and illustrated by Matthew (1888; Plate III) from deformed strata of the Saint John Group in southern New Brunswick. Figure 5a was obtained by scanning a reduced image of Matthew's original illustration. Figure 5b was produced by applying a reverse (vertical) simple shear to Figure 5a, counteracting the original tectonic shear. It is obvious that most of the structural distortion has been removed in Figure 5b. As such, it is a better representation of the actual morphology of *Acadoparadoxides regina* (Matthew, 1888).

Bailiella baileyi (Hartt *in* Dawson, 1868) is another well known Middle Cambrian Acado-Baltic species. Figure 6a was obtained by scanning Shimer and Shrock (1944; Plate 253, Figure 10). Figure 6b was produced by applying a reverse (horizontal) simple shear to Figure 6a. To obtain Figure 6c, the left half of Figure 6b was reflected across the axis of symmetry.

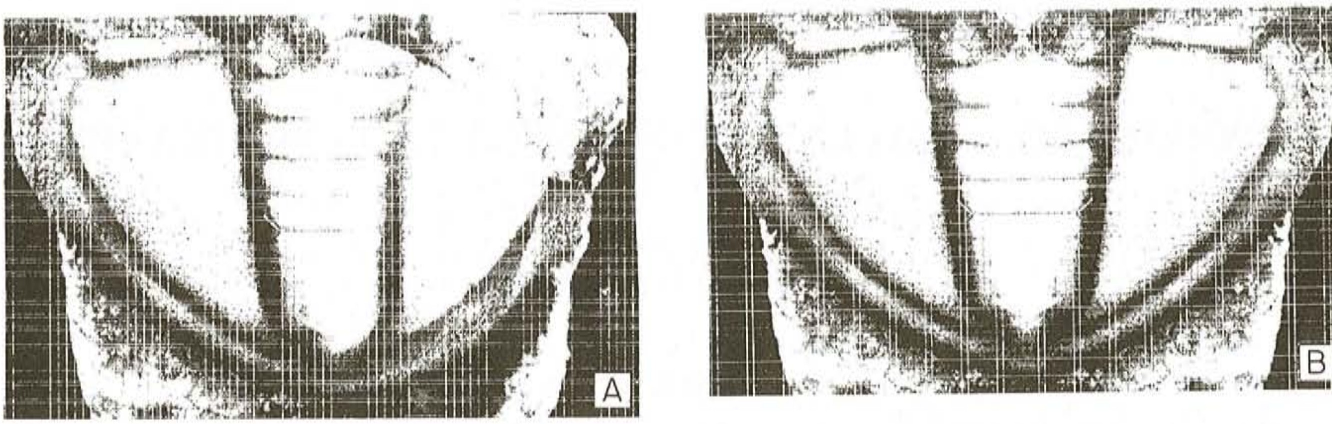

Figure 1. *Computerized images of* Leiostegium proprium *Boyce, 1989 (paratype pygidium, NFM F-111). A: Original scanned image—original of Boyce (1989; Plate 2, Figure 6). B: Symmetrical image—produced by reflecting left side of pygidium across axis of symmetry.*

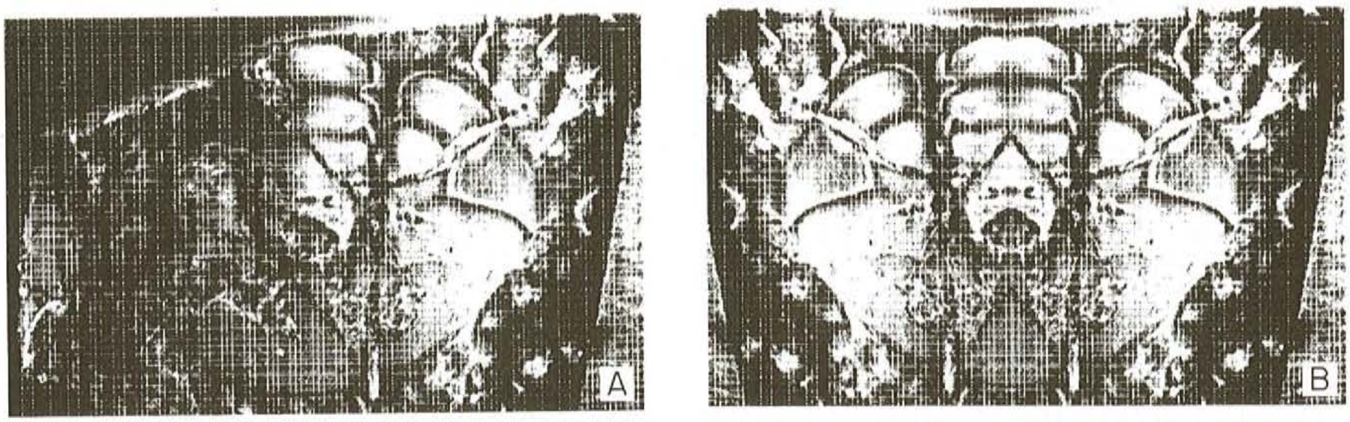

Figure 2. *Computerized images of* Peltabellia *sp. cf.* P. peltabella *(Ross, 1951) (pygidium, NFM F-159). A: Original scanned image—original of Boyce (1989; Plate 29, Figure 3). B: Symmetrical image—produced by reflecting right side of pygidium across axis of symmetry.*

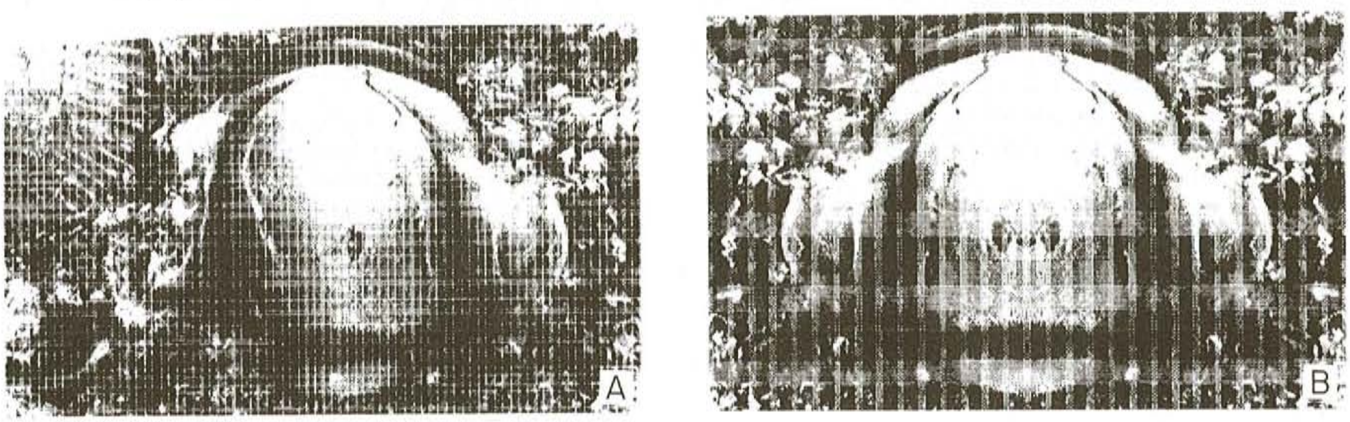

Figure 3. *Computerized images of* Strigigenalis brevicaudata *Boyce, 1989 (paratype cranidium, NFM F-160). A: Original scanned image—original of Boyce (1989; Plate 29, Figure 8). B: Symmetrical image—produced by reflecting right side of cranidium across axis of symmetry.*

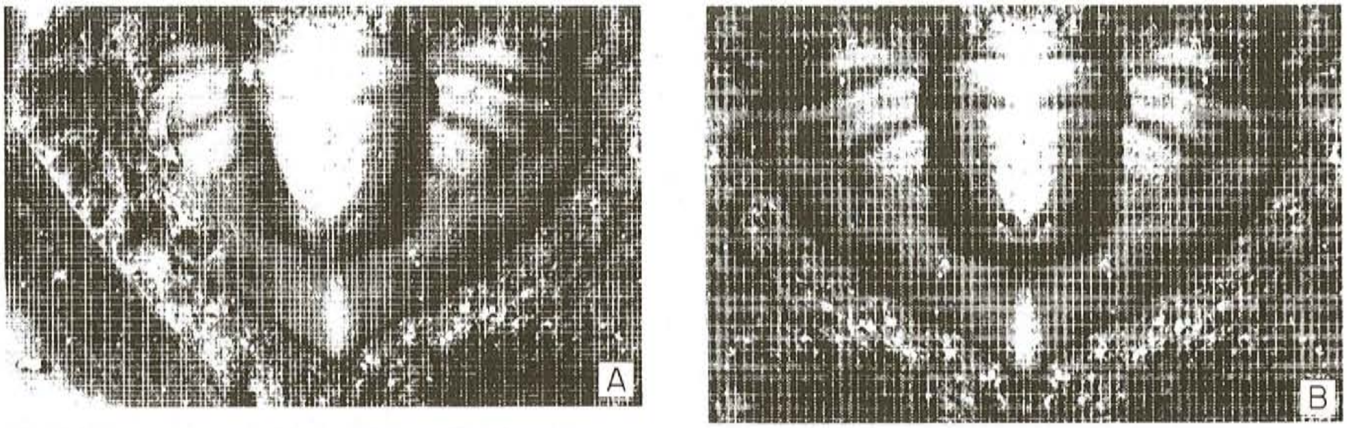

Figure 4. *Computerized images of* Strigigenalis brevicaudata *Boyce, 1989 (paratype pygidium, NFM F-161). A: Original scanned image—original of Boyce (1989; Plate 29, Figure 10). B: Symmetrical image—produced by reflecting right side of pygidium across axis of symmetry.*

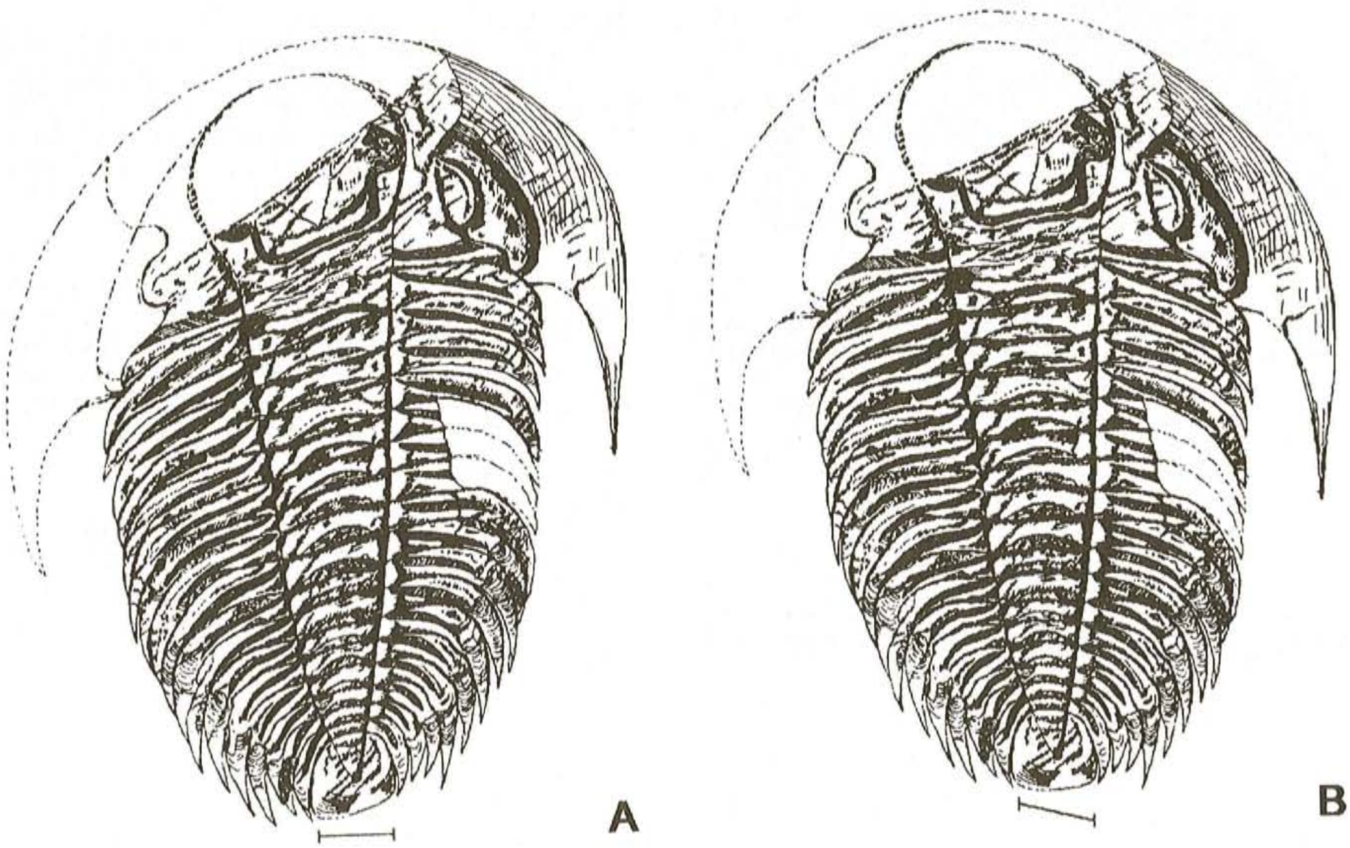

Figure 5. *Computerized images of* Acadoparadoxides regina *(Matthew, 1888). A: Original scanned image—original of Matthew (1888; Plate III). B: Restored image—produced by applying a reverse vertical shear, thereby counteracting original structural shear (note the reference bar).*

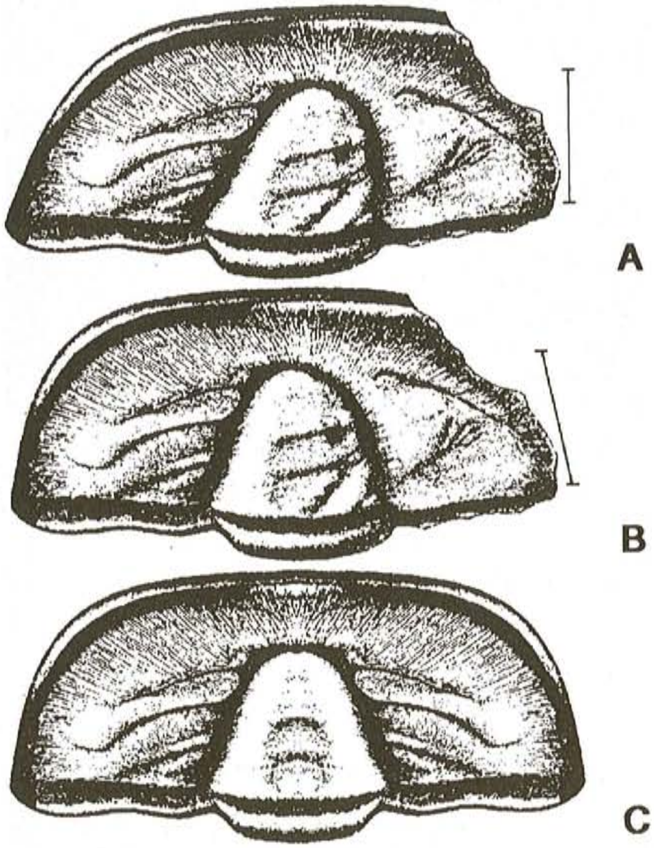

Figure 6. *Computerized images of* Bailiella baileyi *(Hartt* in *Dawson, 1868). A: Original scanned image—original of Shimer and Shrock (1944; Plate 265, Figure 10). B: Restored image—produced by applying a reverse horizontal shear, thereby counteracting original structural shear (note the reference bar). C: Symmetrical image—produced by reflecting left side of cranidium across axis of symmetry.*

SUMMARY

An incomplete trilobite image, if it is undeformed, may be reconstructed by reflecting the more complete half across the axis of symmetry; if the trilobite has been deformed by simple shear, the asymmetry must first be removed by applying a reverse simple shear. The complete trilobite replica may then be taxonomically and, more importantly, biostratigraphically compared with material from other areas.

The reconstruction and proper identification of distorted trilobites is particularly crucial for biostratigraphic correlations in structurally deformed regions, where fossils may be scarce to begin with. There are examples in the paleontological literature where deformed and undeformed individuals of the same species have been described under different names.

The acronym CARROT is proposed for the Computer Aided Restoration—Reconstruction Of Trilobites because of its powerful visual aid.

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