

Digitizing African *Surirellaceae*: a pilot study

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INTRODUCTION

The investigation of African inland diatoms already started in the 19th century. Scientists such as C.G. Ehrenberg (1795–1876), O. Müller (1837–1917), G.S. West (1876–1919), F. Hustedt (1886–1968), B.J. Cholnoky (1899–1972), N. Woodhead (1903–1978), R.D. Tweed (1900–1989), N. Foged (1906–1988), and P. Compère (1934–) described new taxa and depicted their findings by line drawings (many published in Schmidt 1874–1959). Since the 1990's, publications dealing with African micro-algae have started publishing LM and SEM microphotographs (e.g. Compère 1995, Caljon & Cocquyt 1992, Cocquyt 1999a, b, 2003, 2004, Cocquyt & Vyverman 1994).

African diatom taxa have often been regarded as varieties or formas of European species or have been sunk into synonymy. However, more recent taxonomic concepts together with more sophisticated investigation techniques (e.g. SEM) have made the re-evaluation of the African taxa, types as well as typical specimens, a requirement. In the early 1990's a checklist of algae of Lakes Malawi, Tanganyika and Victoria was compiled, highlighting the important biodiversity of the East African Great Lakes (Cocquyt et al. 1993), and underlining the possibility of great diatom endemism in African freshwaters.

More than 100 taxa belonging to the genera *Campylodiscus*, *Cymatopleura*, *Stenopterobia* and *Surirella* were described from non marine sites of the African continent: i.e. 36 taxa were described from East Africa by O. Müller, 5 by G.S. West and 28 by Hustedt, most of them from Lake Tanganyika, 19 taxa by Cholnoky, most of them from South Africa, 9 taxa were described by Foged, 8 by Woodhead & Tweed, three by Compère from West Africa; Ehrenberg listed the occurrence of two *Surirella* taxa at South African sites.

In 2006/2007 the Andrew Mellon Foundation funded a pilot study on digitizing African types and typical specimens of the family Surirellaceae, undertaken by institutions in Belgium, Germany and South Africa. It underlines the taxonomic and ecological actuality of historical diatom collections. For this project, African diatom taxa of the genera *Campylodiscus*, *Cymatopleura*, *Stenopterobia* and *Surirella* from the collections of Ehrenberg (BHUPM), O.Müller (B), West & West (BM), Hustedt (BRM), Foged (C), Woodhead & Tweed (NMW), Compère (BR) and Cholnoky (CSIR; Durban, SA) were screened, identified, LM-pictures taken, and digitized. This is part of the API project (African Plants Initiative), a collaborative initiative aimed at "digitizing all type specimens of African plants kept in southern and northern institutions and disseminating images thereof through appropriate electronic and other means for use by anyone for scholarly purposes".

Since the Cholnoky Collection has been out of scientific use for two decades, this paper is focussing primarily on this very important collection, the largest in Africa and of similar importance as the Hustedt Collection in and for Germany.

MATERIAL & METHODS

The first step in this study on the African Surirellaceae was checking literature data dealing with African diatoms. About 300 publications were consulted, resulting in more than 300 taxon names, belonging to the genera *Campylodiscus*, *Cymatopleura*, *Stenopterobia* and *Surirella*, reported from the African continent. Type localities were identified as well as the herbarium where the type slide and/or type material was deposited.

The next step consisted in digitizing the original drawings present in the South African Diatom collection and in the Botanic Garden and Botanical Museum, Berlin-Dahlem by means of a Canon CanoScan 4400F scanner and a Canon CanoScan N670U respectively. Type slides were also digitized with the same hardware, with a CanoScan D2400U at AWI Bremerhaven, and an Epson HerbScan 10000 XL for all the type slides studied at the National Botanic Garden of Belgium, from own collections as well as from slides loaned from other collections (e.g. Foged from C, Woodhead & Tweed from NMW).

Diatom valves in the type slides as well as valves present in other slides made from African material were photographed under Light Microscopy (Olympus BX 51, Zeiss Axioplan, Nikon 80i) all equipped with Differential Interference Contrast (DIC) using digital cameras (Olympus Color View, Zeiss AxioCam, Nikon DS-U1). Moreover additional Scanning Electron Microscopic pictures were taken of a large number of diatom valves.

All pictures were taken under the highest resolution possible and stored as TIFF format. These high resolution pictures, together with the associated data is being put by Ithaka on a central web site for scholarly and non commercial purposes.

For data evaluation, Simonsen (1987), Silva (1997-) and Jahn & Kusber (2007) were cross-checked.

RESULTS AND DISCUSSION

Müller Collection

The East African *Surirella* taxa of O. Müller in B have been evaluated completely (Jahn 2002, Cocquyt & Jahn 2005a, 2007a, b, c, d), an evaluation of his African *Cymatopleura* taxa is in preparation. Lectotype slides, designated whenever possible, are kept at B. Besides the taxa described by O. Müller, of which many were raised from variety or forma to specific rank and had to be renamed (i.e. Cocquyt & Jahn 2005a, 2007d), a new taxon was observed in the historic material Müller studied: *Surirella olungensis* Cocquyt & R.Jahn (Cocquyt & Jahn 2007b).

Ehrenberg Collection

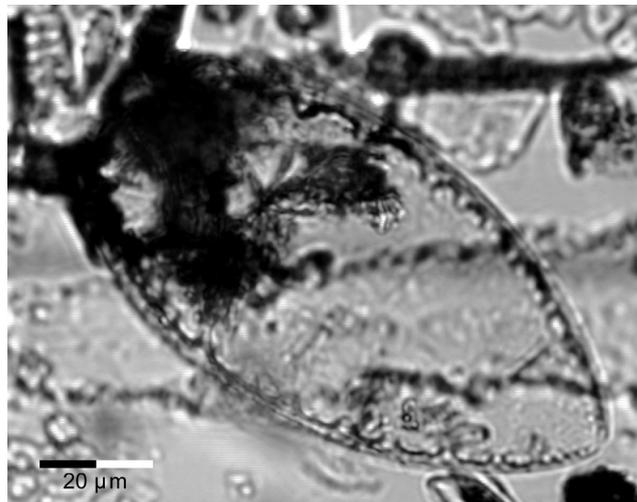


Fig. 1. *Surirella caffra* Ehrenb., nom. inval. (= *S. capensis* Ehrenb. ex Cocquyt & R.Jahn)

Two African *Surirella* names were listed by Ehrenberg as occurring in South Africa: *Surirella capensis* Ehrenb. ex Cocquyt & R.Jahn (2005b) and *Surirella caffra* (Ehrenberg 1854). As for *S. capensis*, Ehrenberg did not provide a name or illustration for *S. caffra* which means that this name is a nomen nudum and therefore invalid. Nevertheless, in the Ehrenberg Collection this taxon is available as a mica preparation (BHUPM: 130808-d yellow). Description of *S. caffra* (Fig. 1): valve heteropolar, ovate with broadly rounded head pole and subacute base pole. Valve face flat, about 10–11 alar canals in 100 µm becoming

denser near the base pole. Poorly developed broad alae, only visible near the valve margin. Each alar canal is subdivided in two to three canaliculi. No striation, punctuation nor pseudoraphe visible. Length: 108 μm , width: 55, length-to-width ratio: 1.96. Locality: Zwartkopsriver, South Africa. This taxon resembles *S. capensis* which has been validated by Cocquyt & Jahn (2005b): length: 78.5–100 μm , width: 48–61.5, length-to-width ratio: 1.6–1.7, 10 costae in 100 μm . However, the length-to-width ratio is somewhat larger and the costae are denser. As only one valve of *S. caffra* and a few valves of *S. capensis* were observed, we think that *S. caffra* falls within the variability of *S. capensis*.

Foged Collection

The new *Surirella* taxa Foged described from Africa all originate from Ghana in equatorial West Africa. Original raw material and slides are kept at Museum Botanicum Hauniense in Copenhagen, Denmark. Digital pictures of Foged's nine *Surirella* types were taken from the holotype slides at BR, as well as some additional SEM (Cocquyt in prep.).

Woodhead & Tweed Collection

The original slides from Sierra Leone from which Woodhead & Tweed described nine new Surirellaceae taxa are kept at the National Museum of Wales, UK. Since Woodhead & Tweed (1958, 1960) did not indicate holotypes, lectotypes will be designated (Cocquyt & Juettnner in prep.) from the existing slides corresponding to the type locality if indicated in their publications.

Hustedt Collection

The African Surirellaceae described by Hustedt are, as part of the entire Hustedt Diatom Collection, kept at AWI, Bremerhaven, well curated and documented (Simonsen 1987). However, the complete digitization of Hustedt's specimens is needed for an even better accessibility. Since Simonsen (1987) evaluated Hustedt's taxa, there are only minor points to discuss 20 years after his publication and two modernizations of the nomenclatural code. Simonsen (1987) sorted Hustedt's taxa by the first publishing date, without completely checking the validity of the first publication. Moreover, Simonsen partly consulted external (unpublished) notes or comments for evaluation and typification. Two examples and corrections are given below:

***Surirella sparsipunctata* Hust.** in Huber-Pestalozzi, *Phytoplankt. Süswass.* vol. 2 (2): 516, fig. 631. 1942.

– *Surirella sparsipunctata* Hust. in A.W.F.Schmidt, *Atlas Diatom.-Kunde*, pl. 309: fig. 15. 1914; nom. inval.

Lectotype: BRM X4/30 [Finder: 469.5] (see Simonsen 1987: 51) designated by: R. Simonsen (1987).

Comment: Simonsen (1987) lectotypified the name citing slide X4/30 as the holotype. In fact slide X4/32 (see Simonsen 1987: pl. 63: fig. 1-3) would have been also available for lectotypification.

***Surirella submargaritifera* Cocquyt & Kusber, nom. nov.**

Replaced synonym: *Surirella margaritifera* Hust. in Huber-Pestalozzi, *Phytoplankt. Süswass.* vol. 2(2): 503, fig. 610. 1942, nom. illeg., non *Surirella margaritifera* Dujardin, *Nouv. Mem. Obs. Micr., Atlas*: 43, pl. 30: fig. 17. 1842.

≡ *Surirella margaritifera* Hust. in *Revue der Gesamten Hydrobiologie* 50: 406. 1965.

– *Surirella margaritifera* Hust. in A.W.F.Schmidt, *Atlas Diatom.-Kunde*, pl. 354: fig. 8. 1922; nom. inval.

Lectotype: BRM X2/85

Isolectotype BRM X2/86

Comment: Lectotype and isolectotype were both designated by Simonsen (1987: 82).

Cholnoky Collection

Concerning the Cholnoky Collection, a program similar to the treatment of the Hustedt Collection would be necessary for: 1) safeguarding Cholnoky's legacy (i.e. Fig. 2, 3); 2)

evaluation of Cholnoky's algal names; 3) selecting types where appropriate; and 4) databasing and digitizing Cholnoky's original drawings and specimens. This collection is in good basic order probably going back to the time when R. Archibald and F. Schoeman were caring for the collection at the CSIR in Pretoria. The non-use for two decades, its removal from active research into the basement at the CSIR in Pretoria when it became privately funded and when F. Schoeman left, its moving from Pretoria to the garage of Colin Archibald in Durban and finally to its current position at the CSIR in Durban disorganized the collection. In addition much of the know-how pertaining to the collection got lost due to its moving and discontinued curation.



Fig. 2. Slides with original material of B. J. Cholnoky held by the Cholnoky Collection. Photo: C. Cocquyt.

Nevertheless, the collection is very extensive and consists of:

1. 15 000 **numbered slides in trays** (no separation of types) (see Fig. 2),
2. Four cabinets with 36 drawers of **samples** organized by a sample acronym (based on geography and publication),
3. hand written **index to the samples** (2) with details on sites as published and indication of the acronyms used,
4. hand written **index to the numbered slides** (1) with indication to sample acronyms. Some of this index, concerning the running waters of Kwazulu Natal, has been databased by C. Archibald for personal use,
5. Cholnoky's **analysis sheets** with detailed species lists, notes in Hungarian or German, and fantastic **original drawings** (see Fig. 3) of the new and special taxa (diatoms, blue greens, desmids, etc.) on squared paper, organized by publication and samples. These analysis sheets are the key to Cholnoky's unmarked types,
6. about 16 000 **slides in slide boxes not numbered**, just broadly labeled according to geography (we found type slides of Cholnoky in these boxes); no index exists to these slides,
7. a large and important collection of **reprints** of Cholnoky and many others, well organized and recently databased on the headquarter server of the CSIR,
8. good collection of diatom and reference books (but not updated in the last 20 years) important for taxonomic research and probably the only ones available in South Africa,

9. many volumes on taxonomic notes on genera and species by R. Archibald and F. Schoeman well organized by alphabet,
10. index to the Giffen collection,
11. Cholnoky's field note books,
12. some maps indicating Cholnoky sampling points,
13. many more boxes with papers and unidentified references and card catalogues, etc.

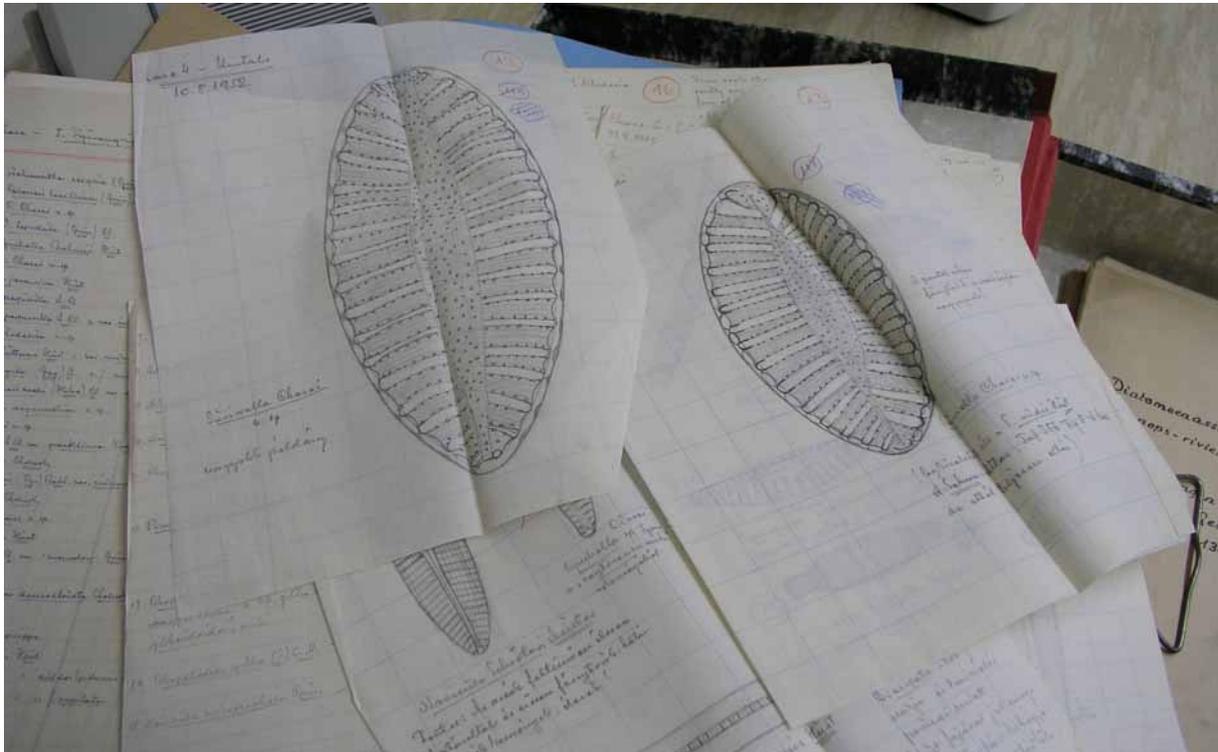


Fig. 3. Original hand drawing of B. J. Cholnoky held by the Cholnoky Collection. Photo: C. Cocquyt.

In the course of this project, we started to locate the types and to digitize the information. Moreover digital photographs of Cholnoky's original drawings were taken, as well as light microscopic photographs. When raw material is available, SEM investigation was done. In case original material was not available anymore, samples from the collection of Jonathan Taylor at the North-West University were studied and will be used to designate epitypes. The study of Cholnoky's African Surirellaceae types by LM and SEM and complemented by material present at the North-West University, is in progress and will result in a number of publications following the strategy used for the O. Müller's types (Taylor & Cocquyt in prep.).

***Surirella oliffii* Cholnoky** in Oesterr. Bot. Z. 103: 90, fig. 134. 1956.

Type: not designated, but indicated. Two collections of one locality were made on 14th October 1953 (Umgeni river by Albert Falls, Kwazulu-Natal, South Africa) and are cited: No. UMG, 3 B 18 and No. UMG 3 B 19.

Comment: In his original description Cholnoky only line drawings were published.

A study on this taxon including lectotypification with material collected by Cholnoky as well as from the collection of Jonathan Taylor allowing SEM investigation and comparison with valves reported from West Africa and referred to as *S. oliffii* will be published later (Taylor & Cocquyt in prep.)

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