

## Australian slugs from the mid-1860s in the collection of the Zoological Museum of Göttingen University (Gastropoda: Athoracophoridae, Limacidae, Milacidae)

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**Abstract:** In the mid-1860s the Zoological Museum of Göttingen University purchased or obtained through exchange some conserved slug material from Australia and New Zealand. This led contemporary museum staff members to describe some taxa and deposit the material in the alcohol collection. The remains of the collection were examined and some preserved types as well as original study material from publications of the 1860s were discovered.

**Keywords:** Australia, New Zealand, *Athoracophorus bitentaculatus*, *Triboniophorus graeffei*, *Limacus flavus*, *Milax gagates*, type material, introduced species

**Zusammenfassung:** In den 1860er Jahren kaufte oder erhielt das Zoologische Museum der Universität Göttingen durch Tausch einiges konserviertes Nacktschnecken-Material aus Australien und Neuseeland. Daraus beschrieben damalige Museumsmitarbeiter neue Taxa und das Material wurde dauerhaft in der Alkoholsammlung des Museums deponiert. Die heute noch vorhandenen Reste dieser Bestände wurden geprüft und einige der erhaltenen Typusexemplare sowie altes Originalmaterial zu den Publikationen aus den 1860er Jahren konnte im Museum wiederentdeckt werden.

### Introduction

The background of this study was a request for a manuscript review. As an editor for pulmonate gastropods of Zootaxa JEFFREY C. NEKOLA asked me in 2017 to review a manuscript submitted by GARY M. BARKER on a catalogue on Athoracophoridae, a family of terrestrial slugs in the South West Pacific region. In this catalogue BARKER reported to have tried without success to detect preserved type material of the 1860s in the collection of the Zoological Museum of Göttingen University. I remembered to have seen very old type material earlier in the alcohol collection and tried to locate this again, and to find answers on how Göttingen University was expected to host original material of Australian slugs. At the end this resulted in a deep dive into history and the rediscovery of syntypes.

### The Zoological Museum of the University of Göttingen in the 1860s

The Zoological Museum of the University of Göttingen (ZMUG) was founded in 1773. Its first curator was JOHANN FRIEDRICH BLUMENBACH (1752-1840, curator between 1773 and 1840), followed by ARNOLD ADOLPH BERTHOLD (1803-1861, curator between 1840 and 1861).

WILHELM MORITZ KEFERSTEIN (1833-1870) was a German naturalist who came to Göttingen in 1852 to study medicine. In 1857 he began a zoological career at the Physiological Institute. After BERTHOLD's death KEFERSTEIN became curator of the Zoological Museum between 1861 and his death in 1870, and founded the Zoological Institute in 1864. He initiated contacts to many institutions in the world and acquired considerable material for the collection. The scope of the present study is to provide a documentation about some slugs from the Australian region which had been studied in Göttingen in the mid-1860s.

When KEFERSTEIN founded the Zoological Institute in June 1864 he started documenting the history of working conditions, the development of the collection and acquisitions in a chronicle and a collection catalogue which are still partly preserved. At this time KEFERSTEIN reported much of BLUMENBACH's collection as lost. KEFERSTEIN initiated the construction of a new building for the Zoological Museum, to host the steadily growing collections.

This new building was finished in 1877, a few years after KEFERSTEIN's death, and hosted the museum as well as an increasing number of zoological departments of Göttingen University for the coming 140 years until 2017. KEFERSTEIN's catalogue may have contained detailed notes on acquired collection material, but these books were largely lost in the following century, as well as much of the initially acquired collection material (WILLMANN 2001). This was caused by the increasing need of space inside the building for educational and administrative purposes in the following century. Between 1920 and 1980 significant parts of the collection were handed over to other museums, at the end of this process in the 1970s Göttingen had finally lost its most precious collections. However, the molluscan and some other collections remained in Göttingen.

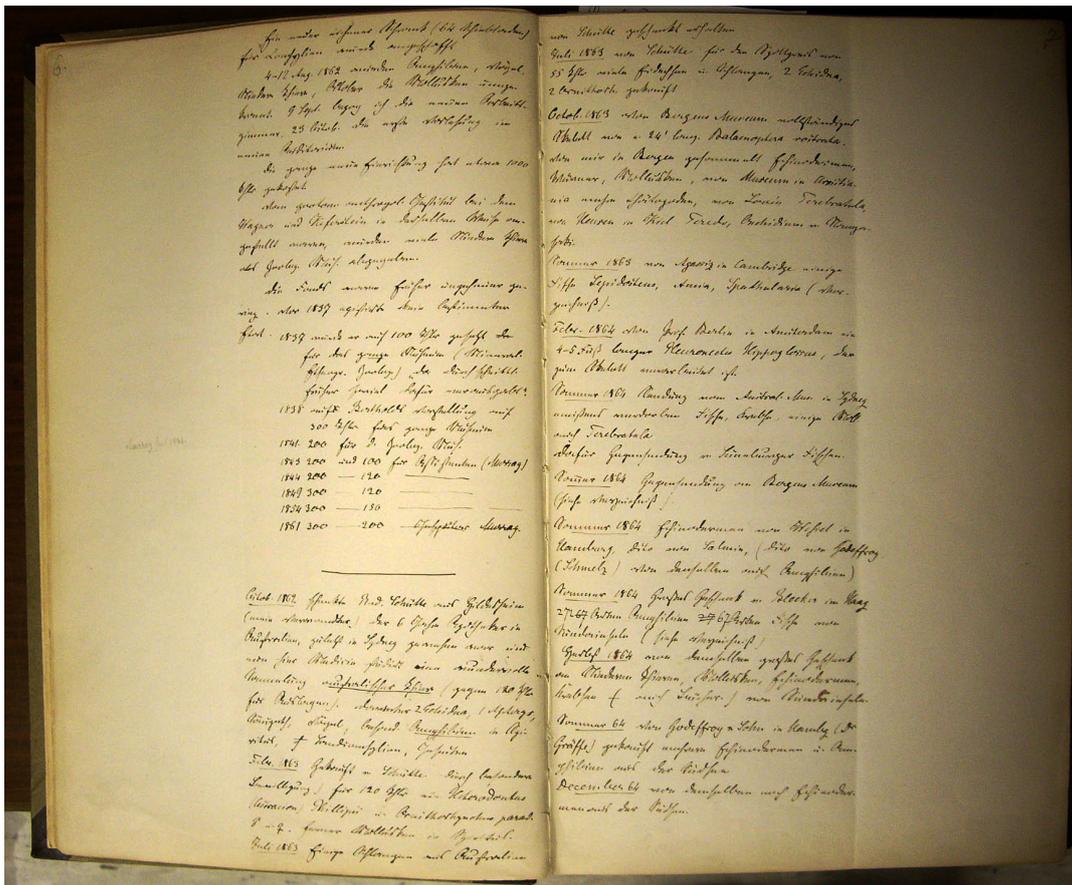


Fig. 1: Handwritten chronicle of the Zoological Museum established by W. M. KEFERSTEIN, here pp. 6-7.

KEFERSTEIN's handwritten chronicle is an important source of information to understand the study circumstances of the Australian material in the mid-1860s. From 1862 onwards KEFERSTEIN repeatedly obtained material from Dr. RUDOLPH SCHÜTTE of Hildesheim (KEFERSTEIN 1865b-d). SCHÜTTE was an important contributor to the collection, he was a brother-in-law of KEFERSTEIN (WILLMANN 2001) and had worked as a pharmacist in Australia for 6 years, lastly in Sydney, before returning to Germany with Australian material collected around 1862 or shortly before.

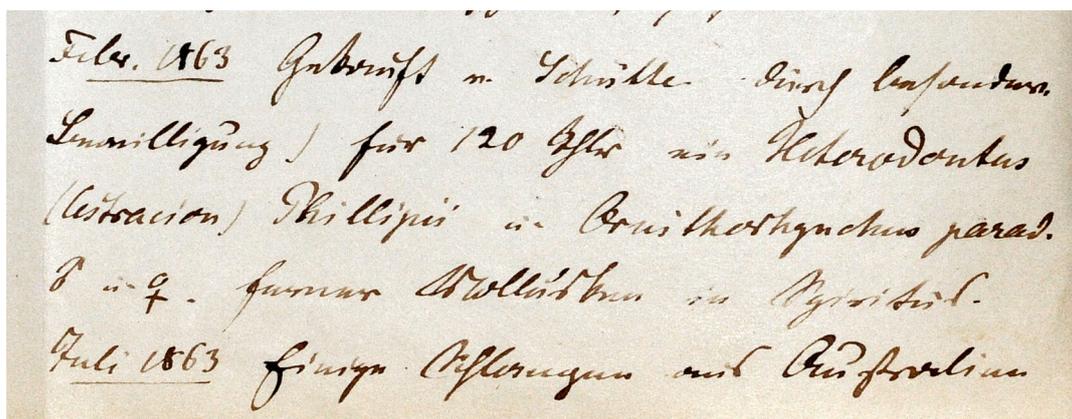
### Studies on Australian athoracophorids

Athoracophorids are succineoidean terrestrial slugs occurring in New Guinea, Vanuatu, Australia and New Zealand. They can easily be distinguished from other slugs in having only two instead of four tentacles. The first species of this family was observed by QUOY & GAIMARD (1832) in the description of *Limax bitentaculatus* from New Zealand. GRAY (1850) established a genus *Janella* for this species (not *Janella* GRATELOUP 1838; Gastropoda: Eulimidae). GOULD (1852) did not mention *Janella* and introduced *Athoracophorus* for the same species. In 1860 GRAY described another genus

and species: *Aneitea macdonaldii* GRAY 1860 from present-day Vanuatu. The first Australian species was described by HUMBERT (1863) as *Triboniophorus graeffei*.

Today the name Athoracophoridae FISCHER 1883 is used. The name Aneiteidae GRAY 1860 was established previously, but since then it was only occasionally used. BOUCHET & ROCROI (2005: 32) maintained the prevailing usage of Athoracophoridae over the senior synonym Aneiteidae (ICZN Code Art. 40.2). The name Janellidae GRAY 1853 cannot be used because *Janella* GRAY 1850 is pre-occupied and invalid (ICZN Code Art. 39).

The study of Australian slugs in Göttingen in this early epoch had to do with personal contacts. The chronicle contains a note on p. 6 that KEFERSTEIN purchased molluscs preserved in alcohol from SCHÜTTE in February 1863 (Fig. 2). From 1864 onwards KEFERSTEIN also reported to have obtained material from the Australian Museum in Sydney, in exchange for other material.



**Fig. 2:** Note on p. 6 of the chronicle on an acquisition of material from SCHÜTTE in February 1863. KEFERSTEIN used two scripts. For proper names, scientific expressions and months he used English cursive writing (Lateinische Schreibschrift) (transcribed in italics in the German text below), for normal text Kurrent writing (Deutsche Kurrentschrift) (transcribed in normal type). It was usual practice in this epoch to use these two script styles in handwritten texts in parallel.

“Febr. 1863 Gekauft v. Schütte durch besondere Bewilligung) für 120 Thlr ein *Heterodontus* (*Cestracion*) *Phillipii* u. *Ornithorhynchus parad.* ♂ u. ♀. ferner Mollusken in Spiritus.

Juli 1863 Einige Schlangen aus Australien”

Translation to English: “February 1863 Purchased from SCHÜTTE through special approval for 120 Thalers one *Heterodontus* (*Cestracion*) *Phillipii* and *Ornithorhynchus paradoxus* ♂ and ♀. Also molluscs in alcohol.

July 1863 Some snakes from Australia”

Some of SCHÜTTE's Australian slugs had only two tentacles. They were examined by KEFERSTEIN in 1864, after having read the publication by HUMBERT (1863) on a new Australian species *Triboniophorus graeffei*. HUMBERT also summarized the literature record on the family.

HUMBERT (1863) dedicated his new species to EDUARD HEINRICH GRAEFFE (1833-1916), a Swiss zoologist who was employed since around 1860 by a wealthy shipping trader from Hamburg, JOHANN CESAR VI. GODEFFROY (1813-1885), founder of the Museum GODEFFROY which existed between 1861 and 1885 in Hamburg. GRAEFFE was based in Samoa since 1862, from where he collected material on many small South Pacific Islands, New Zealand and Australia and sent this material to Hamburg. In this case GRAEFFE sent the slugs to the Swiss malacologist ALBERT MOUSSON (1805-1890) in Zürich. This explains why HUMBERT (1863) reported the types to have been deposited in Zürich, however today they seem to be lost (BARKER 2018: 225).

HUMBERT's publication on *T. graeffei* must have appeared in December 1863. KEFERSTEIN compiled a publication and submitted it in 1864 to the *Zeitschrift für Wissenschaftliche Zoologie*, which was issued in Leipzig. The article appeared on 23 January 1865 (KEFERSTEIN 1865b). In this study KEFERSTEIN revised again the known species of this small family and established two new nominal species: *Triboniophorus krefftii* KEFERSTEIN 1865 and *T. schuetteii* KEFERSTEIN 1865, both from Sydney. KEFERSTEIN reported three specimens of *T. schuetteii* obtained from R. SCHÜTTE, two of which were dis-

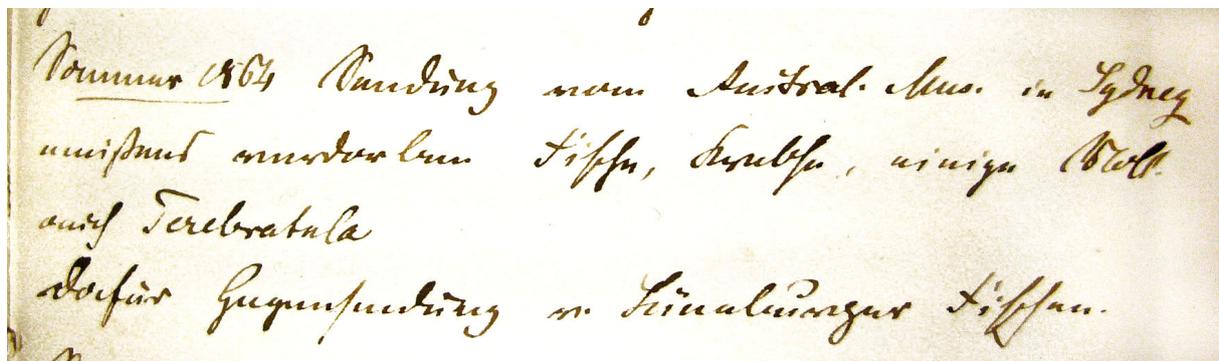
sected, and one specimen of *T. kreffii* without information on the collector. In the chronicle there is no information on that collector either.

The zoologist JOHANN LUDWIG GERARD KREFFT (1830–1881) was curator of the Australian Museum in Sydney (AMS), so it seems likely that KEFERSTEIN obtained the material from the AMS together with specimens of other animal groups such as snakes in 1863 or 1864. KEFERSTEIN's reports of acquisitions in the chronicle were neither complete nor in a strict chronological order.

In the discussion KEFERSTEIN (1865b) compared the new taxa with the previously described species *T. graeffei* from Woollongong in New South Wales, 68 km south of Sydney. Besides these three *Triboniophorus* species KEFERSTEIN recognized two additional species in the family: *Janella bitentaculata* and *Aneitea macdonaldii*.

KEFERSTEIN's two taxa from Sydney are at present regarded as synonyms of *T. graeffei* (see BARKER 2018), a widely distributed species along the coastal margin of eastern Australia (Fig. 5A), commonly known as the red triangle slug, with some isolated occurrences inside the continent (Atlas of Living Australia, [www.ala.org.au](http://www.ala.org.au), accessed 27 Dec 2019). The type material of KEFERSTEIN's taxa was long believed to have been lost, but locality and descriptions were considered sufficient for the classification. A syntype was located in the collection (Tube 5), however with errors on the labels which indicated *T. schuettei* correctly, but New Zealand instead of Sydney, combined with a year 1864, which should read 1863.

We may assume that KEFERSTEIN submitted the manuscript about half a year before it appeared, in the summer or autumn of 1864. In the same journal issue appeared another article by the same author (KEFERSTEIN 1865c) about air-breathing sea slugs (*Peronia verruculata* (CUVIER 1830), Onchidiidae) from Japan and Indonesia, which KEFERSTEIN had obtained from the Dutch zoologist PIETER BLEEKER (1819-1878) from Den Haag. KEFERSTEIN reported in his chronicle to have received molluscs from BLEEKER in the autumn of 1864.



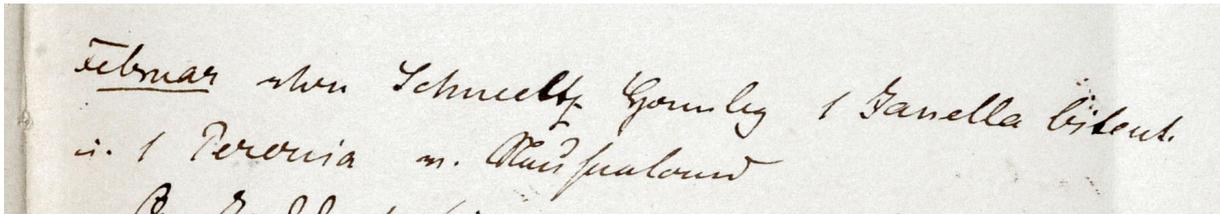
**Fig. 3:** Note on p. 7 of the chronicle on material from Sydney received in summer of 1864.

“Sommer 1864 Sendung vom Austral. Mus. in Sydney  
meistens verdorben Fische, Krebse, einige Moll.  
auch *Terebratula*

Dafür Gegensendung v. Lüneburger Fischen”

Translation to English: “Summer 1864 Mail from Australian Museum in Sydney, mostly decomposed fishes, crustaceans, some molluscs, also *Terebratula*. In return fishes from Lüneburg were sent”

In the summer of 1864 KEFERSTEIN reported in his chronicle to have received another set of material from the Australian Museum in Sydney (Fig. 3), among which were also some molluscs. In February 1865 JOHANNES SCHMELTZ from Hamburg (1839-1909, employed in Museum GODEFFROY since 1863) sent to KEFERSTEIN one 25 mm long (4-5 mm width) specimen of *Athoracophorus bitentaculatus* from New Zealand, collected by Dr. GRAEFFE. KEFERSTEIN noted the receipt in his chronicle (Fig. 4), studied the specimen and gave a detailed description of it, compiled a lithographical plate and submitted another manuscript to *Zeitschrift für Wissenschaftliche Zoologie* carrying the date 01 March 1865.



**Fig. 4:** Note on p. 11 of the chronicle on a receipt of molluscs obtained from Museum GODEFFROY in Hamburg. The account had a title "1865".

“Februar Von Schmeltz Hambg 1 *Janella bident.* u. 1 *Peronia* v. Neuseeland”

Translation to English: “February From SCHMELTZ in Hamburg one *Janella bidentata* and one *Peronia* from New Zealand”

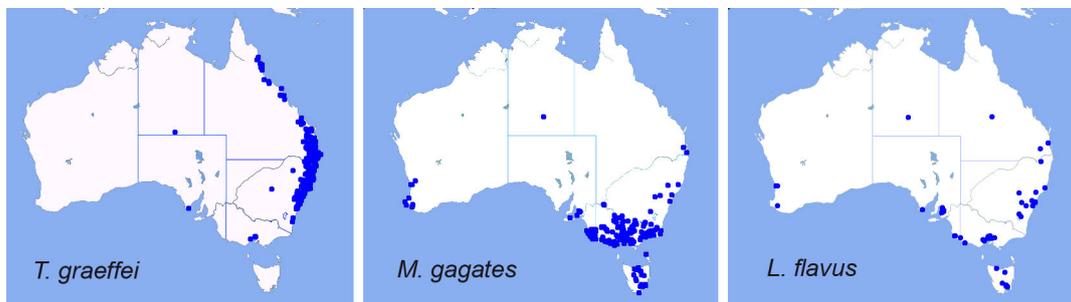
The article (KEFERSTEIN 1865d) was published on 25 October 1865. At this occasion KEFERSTEIN also mentioned that he had obtained some more specimens of *Triboniophorus krefftii* from Sydney, of which he studied the radulae and found that it did not differ much from *T. schuetteii*. In the collection one tube contained a dissected specimen collected by GRAEFFE in 1865 in New Zealand (Tube 13), presumably the corresponding original study material of *A. bitentaculatus*.

### Studies on other Australian slugs

In the same epoch KEFERSTEIN gave some additional preserved slug material from Australia to the 23 year-old student EMIL SELENKA (1842-1902) who finished a manuscript on two new taxa and according to a note in the chronicle submitted it on 30 March 1865 to the journal “Malakozoologische Blätter”.

This article (SELENKA 1865) appeared in May 1865. SELENKA established *Limax pectinatus* SELENKA 1865 and *Limax bicolor* SELENKA 1865, both from Sydney. In the ZMUG slug collection one tube (Tube 8) without preserved information on the label contained three specimens that corresponded well with the descriptions, presumably three syntypes of *L. pectinatus*. *Limax bicolor* could not be traced. SELENKA (1865) reported to have studied one preserved specimen of *L. bicolor*.

The two species were introduced to Australia from Europe. SELENKA did not compare the Australian material with any European species. Based on the original description and illustration WIKTOR (1987: 202) considered *L. pectinatus* as synonym of *Milax gagates* (DRAPARNAUD, 1801). This seems in agreement with the preserved slugs, which could well represent this species. The original description and figure of *Limax bicolor* suggest that this taxon is conspecific with *Limacus flavus* (LINNAEUS 1758) (G. HASZPRUNAR, unpublished). Both species are known to occur in the region of Sydney today (Fig. 5) (Atlas of Living Australia, [www.ala.org.au](http://www.ala.org.au), accessed 27 Dec. 2019).



**Fig. 5:** Present-day distribution of *Triboniophorus graeffei*, *Milax gagates* and *Limacus flavus* in Australia (Atlas of Living Australia, using Open Street Map, 27 Dec 2019).

Interestingly SELENKA (1865) mentioned that the two new species had no similarity (“keine Ähnlichkeit”) with *Limacus* LEHMANN 1864 from Melbourne. LEHMANN (1864) had established *Limacus breckworthianus* from an unidentified Australian locality named “Breckworth, Victoria” and had given a detailed description. It is unclear why SELENKA did not note the similarity.

In Göttingen SELENKA predominantly studied holothurians, which may explain a limited expertise in malacology. The study of Australian slugs in Göttingen ended with these publications and was never continued. SELENKA finished his studies in Göttingen with a dissertation in 1867 (SELENKA 1867). In 1868 he was appointed professor of zoology at the University of Leiden, and in 1874 he became a professor at the University of Erlangen. KEFERSTEIN was appointed regular professor of zoology and comparative anatomy in Göttingen in 1868, and died relatively young at the age of 36 years in January of 1870. Both left behind studied material that partly survived in the collection.

### Preserved original material

In the summer of 1865 KEFERSTEIN installed a new system of labelling glass tubes used for preserved alcohol material. The glass tubes were closed with bee wax, which can close such a tube and keep the alcohol safely inside without any curatorial action for 150 years or longer. Coloured labels were glued on the outer surface of the closed glass tubes, where red colour coded for the Australian region, Africa had blue labels, Asia was yellow, and for America green was used. Data such as locality, collector, species name and date were written with ink on these labels. In this epoch there were no labels inside the tubes. These coloured labels were the only original source of information for the preserved material from the mid-1860s. Since they were glued on the glass, they were not removed and replaced by other labels later.

However, there were several water damages in the past decades, caused by overflows of the nearby Leine river which occasionally flooded the area. Water inundated the cellar of the building, where the alcohol collection was deposited. Glass tubes stored near the bottom were submerged, some glued labels lost contact and came off the tubes. After the water ingressions the room was not dried sufficiently for considerable time, so that almost all the remaining labels were severely damaged by mold. This had the effect that the ink almost disappeared and many labels became impossible or extremely difficult to read. In 2018 most old material was still inside the original glass tubes (Fig. 6), however many had obtained new white labels, partly glued again on the surface of the tubes, while others had labels inside. Only some samples had obtained new tubes in the past decades.

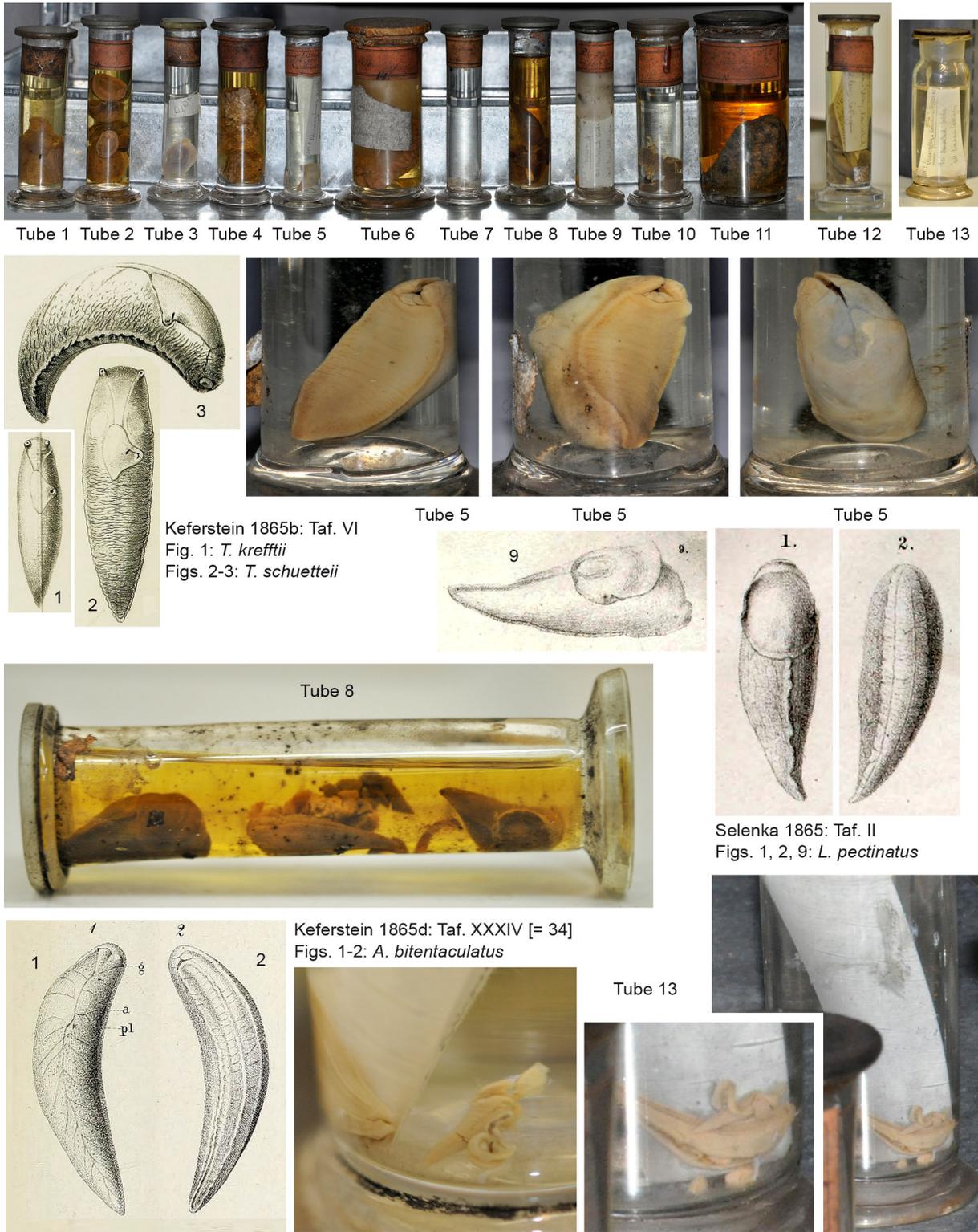


**Fig. 6:** Alcohol collection of molluscs in the Zoological Museum in Göttingen (Berliner Strasse 28) in January 2018. The tubes had different kinds of labels, often glued outside on the tubes, some inside. Some tubes still had the colour labels from KEFERSTEIN's original labelling introduced in 1865, however rarely with visible text on them. The collection was moved into another building later in the same year.

In 2018 several samples in the slug collection carrying remains of the original red labels coding for the Australian region were found (Fig. 7 first row), however not all were slugs.

Tube numbers in this presentation are in arbitrary order following the arrangement in the photos (Fig. 7 first row). In January 2018 the tubes had no inventory numbers.

- Tube 1 contained one preserved animal of an unidentified invertebrate group, nothing visible on the damaged label.
- Tube 2 contained six specimens of Onchidiidae, label reading “SCHÜTTE 1864 Sydney”, and a number “16” written later on it, with unrecorded meaning (same style as on tubes 6 and 11).
- Tube 3 contained an 'opisthobranch' mollusc (e-mail G. BARKER, Feb 2018) with shell, nothing visible on the red label. A white label has something like “Eó1” written on it, with unknown meaning.
- Tube 4 seemed to contain a sea slug with tubercles. The red label indicated “R. SCHÜTTE 1865”, it also had locality and scientific name on it, below it eventually an authorship for the name, but these were only fragmentarily preserved.
- Tube 5 contained a 2.5 cm long athoracophoran slug (Fig. 7 second row). The red original label indicated “Triboniophorus Schüttei / Kef ? Gräffe 1864. Neu-Seeland” in KEFERSTEIN's handwriting, and “Athoracophorus Kef ?” in a different handwriting with pencil. A modern label was inside the tube, from around 2002, reading “211 1 Athoracophorus schüttei KEF? 1864 Neuseeland Gräffe Zool. Mus. Göttingen”. A dirty white label glued outside on the lower part of the tube did not contain any preserved information. It is very probably a syntype of *T. schuettei* KEFERSTEIN 1865. The indication “New Zealand” was very probably incorrect, correct should have been Sydney, Australia (the genus has never been reported from New Zealand). The tube was labelled more than one year after the content had been collected in 1863 and studied in 1864, since the new system of labelling tubes was introduced in summer 1865. This might explain the inaccurate information on the original label.
- Tube 6 contained a big slug. It had a red label reading “Schütte Sydney”, and a white dirty label glued outside, also reading “Schütte” and “Sydney”, and probably some more information on the date starting with 186. In addition the red label had a number “14” with unrecorded meaning (same style as on tubes 2 and 11).
- Tube 7 contained a tunicate, red label reading “Clavellina”, a misspelling for *Clavelina* SAVIGNY 1816 (Tunicata).
- Tube 8 contained three keeled terrestrial slugs, one seemed to have been dissected (Fig. 7 third row). It had only a folded fragment of the red label attached on the tube. Comparing with the information given in the original description these can be identified as the three syntypes of *Limax pectinatus* SELENKA 1865.
- Tube 9 contained one specimen of Onchidiidae, not identical with the one studied and figured by KEFERSTEIN (1865d: Taf. 6 Fig. 14-15) from Japan. Red label reading “Peronia Gräffe 1864 Neu-Seeland”. The more recent white label inside reading “190.1 Peronia sp. 1864 Neuseeland Gräffe Zool. Mus. Göttingen”.
- Tube 10 contained three specimens of unknown identity, not typical slugs, not athoracopoids (e-mail G. BARKER, Feb. 2018), red label probably without text.
- Tube 11 contained a relatively big sea slug. Its red label had no text besides a No. “10” of unrecorded meaning (same style as on tubes 2 and 6), but could initially have had some information written on it.
- Tube 12 contained six slugs, each one about 25 mm long. The red label had no visible text. A white label inside from around 2002 indicated in handwriting “Athoracophorus dubius COCK. Pelorus Valley, Neuseeland Zool. Mus. Göttingen”. Another white label in a different handwriting indicated “Athoracophorus dubius Coc[?] Pelorus Valley”. The species name referred to *Neojanella dubia* COCKERELL 1891. COCKERELL (1891: 217) described this taxon from “Cook's Straits” in New Zealand, the holotype is deposited in the Natural History Museum in London (BARKER 2018). Its taxonomic position is currently unclear (BARKER 2018). The slugs seem to represent *Athoracophorus bitentaculatus* (e-mail G. BARKER, Feb. 2018).
- Tube 13 was not equipped with a red label and had a different tube format, but contained a label indicating that it was original material from 1865. It contained one small specimen (around 10 mm) of a dissected slug with body parts not displaying diagnostic features, and a slug of around 25 mm length (Fig. 7 bottom row). A white label inside from around 2002 indicated in handwriting “211.3 Athoracophorus bitentaculatus (Q & G) 1865 Neuseeland Gräffe Zool. Museum Göttingen”. This was probably the original material of the KEFERSTEIN (1865d) study, *A. bitentaculatus*.



**Fig. 7:** Samples of preserved mid-19th century slugs from the Australian region. First row, arrangement of 13 tubes. Second row, selected original figures of KEFERSTEIN (1865b) and preserved original material in Tube 5, syntype of *Triboniophorus schuettei* KEFERSTEIN 1865. Third row, selected original figures of SELENKA (1865) and preserved original material in Tube 8, syntypes of *Limax pectinatus* SELENKA 1865. Bottom row, selected original figures of KEFERSTEIN (1865d) and preserved original study material in Tube 13, *Athoracophorus bitentaculatus* (QUOY & GAIMARD 1832).

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