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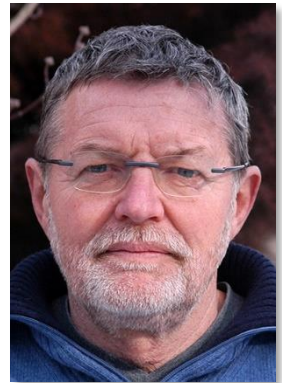
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Cover picture: Fruit of *Gymnocalycium arzbergeri* VoS 1201 (photo: Reiner Sperling).

Editorial

Dear *Gymnocalycium* friends,

Wolfgang Papsch



As is the case with all the cacti genera in northern and Latin America, new and unknown aspects can be discovered in the genus *Gymnocalycium* during extensive field excursions even today. When leafing through contemporary cacti and succulent literature, the abundance of descriptions of new plants is surprising, be it cacti or other succulents, the systematic rank of genus or of species, although as early as in the early 20th century proven experts rejected many a submitted description of a supposedly new discovery, reasoning that in the well-combed through cacti areas of their countries of origin no new finding was possible.

There are several reasons for discovering new populations, such as better road conditions, new access to so far inaccessible areas, exploration of regions that have not been deemed worth visiting to this day or have simply been left aside as no cacti were expected there. In addition, intensive preoccupation with the plants in habitat and cultivation, together with innovative investigation methods reveal that plants have been assigned wrongly to a taxon erroneously and that the plant is a species in its own right. On the part of science many descriptions are criticised or rejected though mostly no conclusive explanations is given.

Botanists' opinion concerning cacti systematics is presented in a new edition and supplement of a monster opus by all in all 18 reviewers and authors. This list of cacti species called Cactaceae at Caryophyllales.org – a dynamic online species-level taxonomic backbone for the family is available online (<https://caryophyllales.org/cactaceae/Checklist>).

Naturally, the part dealing with plants from the genus *Gymnocalycium* is of special interest for *Gymnocalycium* friends. Being not only aware that in the past there were too many descriptions in this genus, too, but also that there is a lot of ignorance about possible connections or those to be excluded within the known taxa, we must definitely cast a sceptical eye on the presented list of species.

This list, however, clearly indicates that desk work cannot replace intensive and meticulous study of the plant. Some of the list's deductions can only be explained by the reviewers' not knowing the plants. Probably (or certainly) they have not seen the plants yet, let alone investigated them. Maybe an inspiring dialogue between scientists and amateurs can bring about results. Such a dialogue can make both sides recognize and obliterate mistakes.

Let us stick to new descriptions. This edition presents the Gymno friend again with a new species. The author, renowned expert of Paraguayan and Bolivian *Gymnocalycia* and *Fraileae*, has proved his classification as a new species with facts. Between discovery and description of the plants there were ten years of studying the new species, in collection, under ideal conditions of cultivation. From the seed to the adult plant, from seedling to flower and anew production of seeds, all steps of vegetation have been documented and compared with possibly related taxa. It will be interesting to see how science will evaluate this new taxon in the future and in which position of the species list it will appear.

For the International Conference 2022 in Linz (Austria) the topic *Gymnocalycium schmidianum* versus *G. glaucum* was chosen. Individual categories like locality determination of type localities,

differences in habitus and flower of the various populations as well as seed features were discussed in three discussion forums. The research of type localities can be studied below.



Gymnocalycium schmidianum, Prov. Catamarca, RP 11, 24 km S Tinogasta (photo: Papsch).

We would like to express our warmest thanks to Mrs Iris Blanz (Austria) who supports us with the translation into English, to Mrs Larisa Zaitseva (Russia) for the translation into Russian, to Mr Victor Gapon (Russia) for the content corrections of the Russian edition, to Mr Takashi Shimada (Japan) for the translation into Japanese, to Mr Jiahui Lin (China) for the translation into Chinese, to Mr Václav Johanna (Czech Republic) for the translation into Czech and to Mr Daniel Schweich (France), who has mirrored our publications under <https://www.cactuspro.com/biblio/>.

An Unexpected Discovery from Departamento Presidente Hayes in Paraguay – *Gymnocalycium arzbergeri* Schädlich spec. nov.

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ABSTRACT

A so far unknown *Gymnocalycium* population, which was found in Departamento Presidente Hayes in Paraguay, is described as *Gymnocalycium arzbergeri* Schädlich. Distinguishing criteria from *G. anisitsii* (K. Schum.) Britton & Rose and *G. mihanovichii* (Frič & Gürke) Britton & Rose are discussed.

KEYWORDS: *Gymnocalycium*, *arzbergeri*, *anisitsii*, *mihanovichii*, Paraguay.

INTRODUCTION

Departamento Presidente Hayes is the southernmost of three administrative districts of Paraguay's Chaco. It borders on Argentina in the south, with Rio Pilcomayo forming a natural border over a long distance. It is situated next to the two other Chaco Departamentos Boquerón and Alto Paraguay to the west and the north. While the landscape is characterized by dry forests with thorn bushes in the north, there are mainly palm tree savannahs in the south. The Chaco savannah is dominated by grassland and one single palm tree species, namely the Caranday wax palm (*Copernicia alba*). The flat terrain is interrupted by higher-lying dry islands. After extensive rainfall in spring vast parts of the landscape are submerged, being heaven for waterfowl, serpents and caimans.



Fig. 1: Landscape along the road from Concepción to Pozo Colorado: the scenery is characterized by palm tree groves and estancias.

During an excursion in 2012 Alexander Arzberger (Paraguay), Christian Hefti (Switzerland) and I were on our way back from Departamento Concepción. We drove in the direction of Pozo Colorado (fig. 1) in order to travel further north later on.

Two days previously we had been able to detect the area specified by János Dániel Anisits as type locality of *G. anisitsii* (K. Schum.) Britton & Rose. We could indeed discover plants there, to our great surprise and owing to the kind help of native people, we found the plants between palm trees and deciduous trees. The species even grew on palm tree trunks in places. These impressions were still fresh in our memory while we were driving along the road from Concepción to Pozo Colorado. I had been driving along that route several times during other journeys, so the endless dull grass and palm tree savannahs did not arouse any urgent need in me for stopping and searching for cacti. However, our attentiveness was rewarded. From the roadside we could spot some *Cleistocactus baumannii* subsp. *horstii* (P. J. Braun) N. P. Taylor, promising index plants for possible proximity with spherical cacti. And that was the case indeed. Shortly after that did Alexander find a large specimen of the genus *Gymnocalycium* (fig. 2).



Fig. 2: The discovered *Gymnocalycium* at locality VoS 1201. The plants can grow to a height of up to 25 cm, at older age they start forming shoots at their base.

We could already discover the unusual flowers at the locality. They resemble the flowers of *G. mihanovichii* (Frič & Gürke) Britton & Rose (fig. 3-4). From the seeds taken along with us plants were cultivated and closely observed (fig. 5-7).



Fig. 3: *Gymnocalycium spec.* VoS 1201 at its locality. Budding takes place out of old areoles, often at the apex.



Fig 4: *Gymnocalycium spec.* VoS 1201 at its locality. The flowers are always yellowish green.



Fig. 5: *Gymnocalycium spec.* VoS 1201 in cultivation. The largest of the plants cultivated from habitat seeds (F1-generation). Juvenile plants lack the pronounced central spine present at older age.



Fig. 6-7: Second and third specimen of flowering adult plants from VoS 1201 in cultivation. The spine arrangement of the plants is distinctive and unique within this group of related species.

As the discovered plants show similarities in habitus to *G. anisitsii* (K. Schum.) Britton & Rose and their flowers resemble those of *G. mihanovichii*, an in-depth comparison with both species was carried out. In doing so specimens of *G. anisitsii* VoS 28, 523, 525, 1200 and *G. mihanovichii* VoS 26, 231, 2129 were investigated (fig. 8-11).



Fig. 8: 2- and 3-year-old seedlings from VoS 1201. The seedlings mostly start flowering for the first time after three years (plants in 5 cm pots).



Fig. 9-10: 3-year-old seedlings, left *G. arzbergeri* VoS 1201 and right *G. anisitsii* VoS 1200, the number of ribs is different in both plants (plants in 5 cm pots).



Fig. 11: 3-year-old seedlings of *G. mihanovichii* VoS 2129. Growth in cultivation is markedly less with this species, even adult plants of *G. mihanovichii* mostly form only 8 ribs, rarely up to 10 (plants in 5 cm pots).

After ten years of cultivating the sowings from locality VoS 1201 and with features stable in all F1- and F2-breeds as well as further visits to the habitat, the following plants are described here at species' rank.

***Gymnocalycium arzbergeri* Schädlich species nova**

Diagnosis: Differs from *G. anisitsii* (K. Schum.) Britton & Rose in having more numerous and more tubercular ribs at juvenile age and a different flower. Differs from *G. mihanovichii* (Frič & Gürke) Britton & Rose in body colour, in possessing more and higher ribs, and in non-existent transverse epidermic banding and spine position.

Typification: The plants grow in stoneless, sandy soil interspersed with loamy clay admixture, Department Presidente Hayes, Paraguay, under the cover of grasses, small bushes and

bromeliads, at an altitude of 86 m a.s.l.. First finding date: September 15th, 2012. Herbal material: plant cultivated from habitat seeds. Holotype VoS 1201/2874 (Herbarium WU 4038).



Fig. 12: Budding plant of *G. arzbergeri* at its locality. The plants mostly grow solitarily in their habitat.

Description

Body: solitary, flat spherical, at old age forming scions at the base and short columnar, up to 12 cm in diameter, up to 25 cm high, epidermis green, matt, apex slightly indented, fibre roots (fig. 12).

Ribs: 9(-10)-15, straight, dissolving into small axe-shaped tubercles with a short transverse groove in between, lighter green with \pm dark green dots.

Areoles: round to slightly oval, initially with a little yellowish woolly felt, later turning grey, a gap of about 15 mm between areoles on the ribs.

Marginal spines: 5(-7), up to two longer ones on the upper side of the areole pointing upwards, up to 23 mm long, up to two pairs of spines sticking out left and right laterally, up to 20 mm long, one spine at the bottom of the areole pointing downwards, up to 20 mm long.

Central spine: 1, mostly still missing in seedlings, up to 40 mm long.

All spines: sticking out radially, not tight to the body, \pm hard, needle shaped, horn coloured, darker towards the tip, brownish, later all of them growing grey.

Flowers: originating from the rim of older areoles, appearing during the whole vegetation period, not infrequently several ones flowering at the same time, bell-shaped, up to 60 mm long, up to 30 mm in diameter in full anthesis. Flowers open only slightly in great heat, most of the time the

perianth remains slanting towards the centre like a tulip bud, yellowish green. Pericarp green, covered with reddish brown scales, scales spatula-shaped with small tip, with whitish rim. Interior wall of the receptacle white to light yellowish, outside yellowish green covered with scales of the same colour, spatula-shaped with small, sometimes reddish brown tip, white rim. Outer perianth narrow spatula-shaped, 27x6 mm with green middle stripe and reddish brown tip, inner perianth 15x4 mm, yellowish green with \pm faint or no middle stripe at all, colour of tip like that of outer perianth. Primary filaments inserting at the top end of the \pm tube-shaped nectar chamber, leaning against the style. Secondary filaments covering the stigma, inserting in several rows. Filaments whitish, stigma up to 13 mm long, greenish, anthers and pollen yellowish, stigma light yellow (fig. 13).



Fig. 13: Detail photograph of *G. arzbergeri* at its location. The buds frequently appear very numerous in several rows. The species is everblooming from spring to late autumn in cultivation (photo: C. Hefti).

Fruit: Spindle-shaped, up to 30 mm long and up to 13 mm wide, ripping open vertically when ripe, turning red, pulp violet.

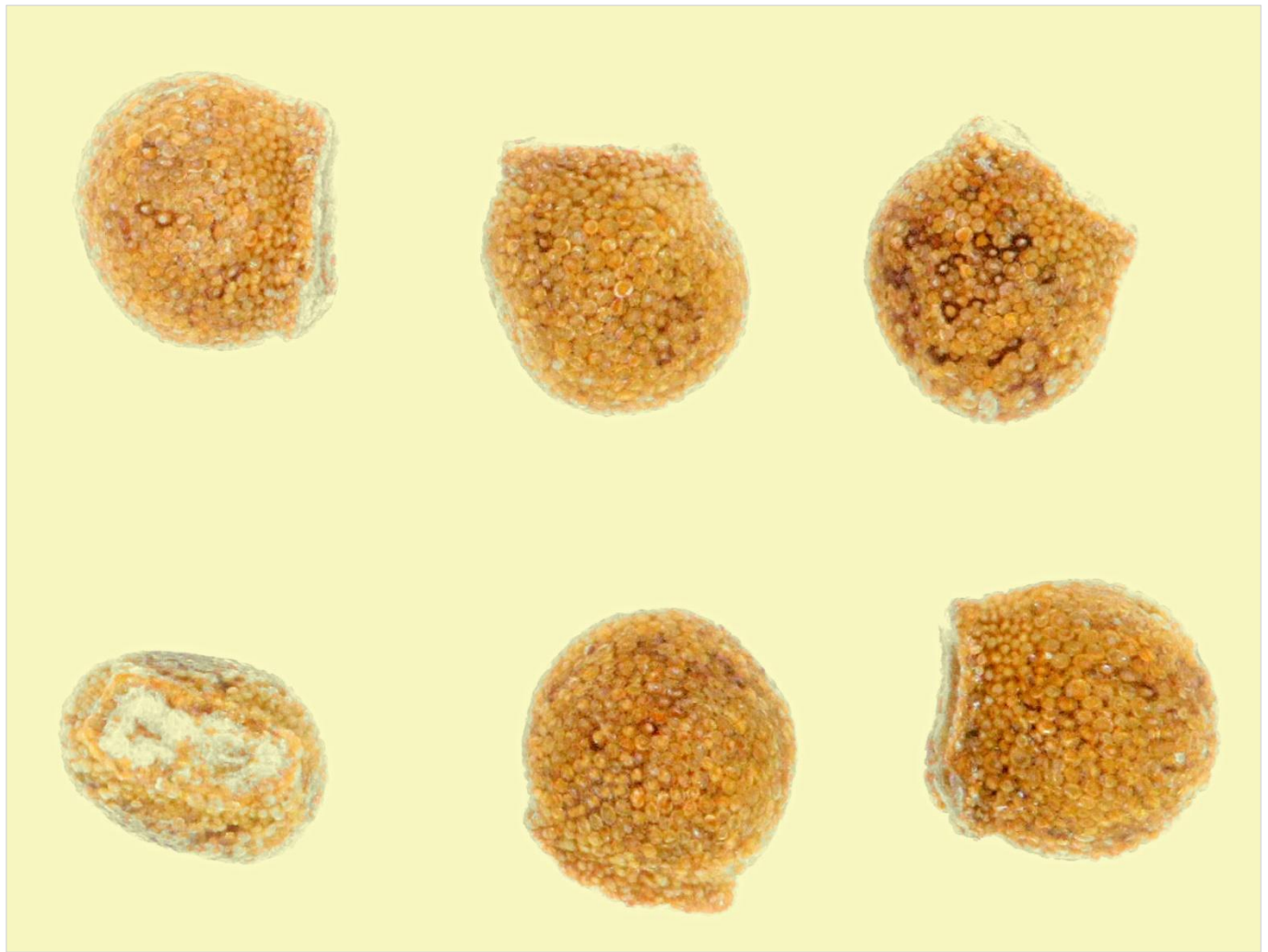


Fig. 14: Seeds of *G. arzbergeri*. Length 0.70-0.90 mm, $M(30) = 0.803$ mm. Width 0.65-0.83 mm, $M(30) = 0.752$ mm.

Seeds: Seeds \pm short ovoid to almost spherical, towards the basally situated hilum-micropylar-region (HMR) \pm cropped straight (fig. 14). Length 0.70-0.90 mm, $M(30) = 0.803$ mm. Width 0.65-0.83 mm, $M(30) = 0.752$ mm. Testa light brown, matt. Outside walls of the isodiametric testa cells pronouncedly cupola-shaped, on top often \pm strongly indented, even caved in. On the visible parts of the outside walls an often \pm evenly spread, loosely to more compactly arranged cuticula folds, in parts short, somewhat coarser cuticula folds. Walls and corners of neighbouring cells not recognizable due to their low position. HMR (fig. 15-16) mostly wide oval, occasionally almost rectangular to the shape of an 8, somewhat lowered, often covered with whitish-yellowish to brownish tissue rests originating from the funiculus. After removing these rests the bottom of the HMR appears blackish brown with two indentations; the short conical micropylar region, which does not surpass the rim of the HMR, rises in the smaller one; in the larger one there is the irregularly shaped ruptured funiculus. Rim of the HMR \pm wide, not bulging, mostly running down straight. There are seeds where the rim runs straight down in some sections, but is somewhat bent outside in other places. Subgenus *Muscosemineum*. Below SEM-pictures of the seed of *G. arzbergeri*.

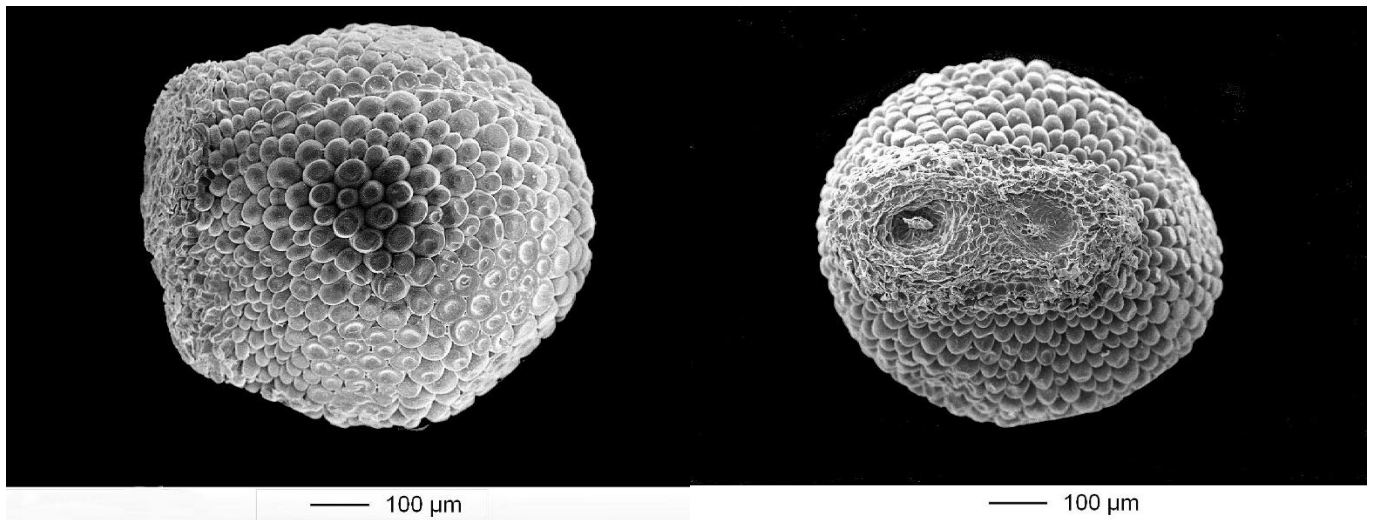


Fig. 15: Seeds in lateral view: hilum-micropylar-region (HMR), (leftmost in the picture) ± cropped straight. Tips of testa cells visibly indented in the seed's apex region.

Fig. 16: Seed in dorsal view on the wide oval HMR; left indentation with short conical micropylar region, right indentation with ruptured funiculus.

Occurrence: The plants grow in sandy soil devoid of rocks interspersed with loamy clay admixture, protected by grasses, small bushes and bromeliads. Further accompanying vegetation is *Echinopsis rhodotricha* K. Schum., *Cleistocactus baumannii* subsp. *horstii*, *Harrisia bonplandii*.

Etymology: The species is named after Alexander Arzberger, Itá, Departamento Central, Paraguay, collector of cacti and travel companion.

DISCUSSION

The new species resembles *G. anisitsii* in its habitus. The plants grow at their locality under the same conditions as *G. anisitsii*. In its juvenile state the plant can be easily told apart from *G. anisitsii* by its numerous and tubercular ribs. *G. arzbergeri*'s flowers differ in colour, which is always yellowish green without variability. *G. anisitsii*'s flowers are white to delicate rose coloured. *G. anisitsii* forms funnel- or slightly bell-shaped flowers, *G. arzbergeri*'s flowers are always distinctly bell-shaped (fig. 17-18).



Fig. 17-18: Flower sections, left *G. arzbergeri* VoS 1201, right *G. anisitsii* VoS 1200.



Fig. 19: Comparison of flower sections, left *G. arzbergeri* VoS 1201, centre *G. anisitsii* VoS 525, right *G. mihanovichii* VoS 2129.

Another distinguishing feature are the anthers, which are grey to blackish with *G. anisitsii*, whitish with *G. arzbergeri*.

There is no similarity in habitus to *G. mihanovichii*. Both species differ in body colour, number and structure of ribs, transverse epidermic banding and arrangement of spines. However, the flowers are very similar. As with *G. arzbergeri*, they only open in great heat and the inner petals only little so. The stigma of *G. mihanovichii* mostly remains enclosed by the secondary filaments. While flower colour is always yellowish green with *G. arzbergeri*, it varies with *G. mihanovichii* from yellowish green to brownish orange (fig. 19). All three species belong to the subgenus *Muscosemineum*. There are only slight differences concerning the seeds of the three investigated species. The seeds of *G. anisitsii*, however, often possess an outward bent rim in the hilum-micropylar-region (HMR), which again distinguishes them from *G. arzbergeri*.

STATUS OF ENDANGERMENT

The so far known habitat of *G. arzbergeri* is very small. Up to now only this single locality has been known. The main danger arises from further urbanisation of the landscape. The habitat is situated in the border region of an estancia. The strips of land covered with original vegetation are small and thus especially susceptible to any change, be it climate change or human activities (fig. 20). For this reason, the status of endangerment is classified as high (VU vulnerable).



Fig. 20: Habitat of *G. arzbergeri* together with *Stetsonia coryne*. The strips of land with original vegetation are small.

ACKNOWLEDGEMENT

I am very grateful to Prof Lothar Diers, PhD, Bad Neuenahr, Germany, for his help with investigating, evaluating and describing the seeds and for making SEM pictures available. My thanks also go to Christian Hefti for providing photographs.

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Remarks on the Type Localities of *Gymnocalycium glaucum* and *G. schmidianum*

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ABSTRACT

Gymnocalycium glaucum Ritter and possible relationship of this species with *G. schmidianum* Hans Till & Walter Till and its subspecies *G. schmidianum* subsp. *asperum* Kulhánek & Meregalli was the main topic of the 2nd International Meeting in Linz. The aim of this discussion group was to critically scrutinize those three taxa as to their mutual relationship. It was clear from the beginning that plants for comparison could not be used at random, originating from different localities or field collectors, but that type localities were a decisive factor in order to establish a common basis for discussion.

Keywords: *Gymnocalycium, glaucum, schmidianum, subsp. asperum.*

INTRODUCTION

Only features of plants from type localities can be used as a starting basis for further discussion. This issue inevitably leads to the question whether the type localities of the three taxa can be located exactly. In order to establish the places where the plants were found, not only Franz Strigl and Hans Till's field notes are at our disposal, but also personal information from Franz Strigl, Massimo Meregalli and Tomáš Kulhánek. The fact that these days we have digital access to Friedrich Ritter's diaries via the Deutsche Kakteengesellschaft (German Cacti Society) makes it possible to follow Ritter's routes as well and thus define the exact localities of his collections. Other sources of information consulted were the deposited herbarium sheets in Utrecht, Turin and Vienna.

The localities of the plants under discussion can on the one hand be found in Province Catamarca, starting at the Cordillera Buenaventura in the north and running along for about 140 km as far as the western side of the Sierra da Copacabana in Province La Rioja in the south. On the other hand, they occur in Catamarca, too, along the border with La Rioja, starting at the southern side of the Sierra de Vinquis and stretching in eastern direction as far as the Sierra de Velasco (fig.1).

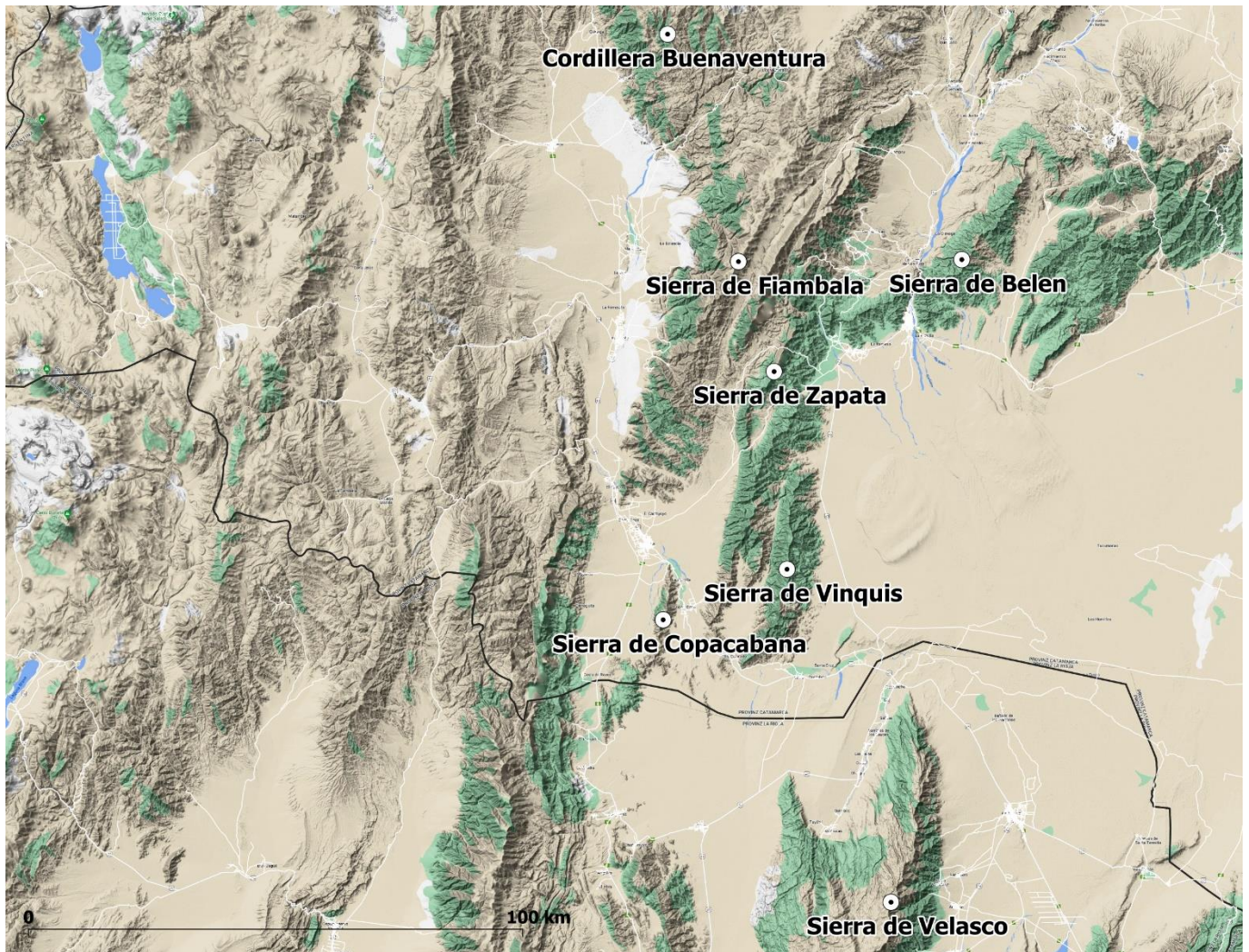


Fig. 1: Finding area of the three *Gymnocalycium* taxa

(basic map: Google).

DISCUSSION

1. *Gymnocalycium schmidianum* subsp. *asperum*

For *G. schmidianum* subsp. *asperum* an exact determination of the type locality is possible due to the authors' mentioning the GPS data in their first description. On 22nd January, 2011 Massimo Meregalli and Andrea Funetta found these plants at an altitude of 2.642 m a.s.l. around 18 km north of Antinaco in Province Catamarca. In addition to the GPS data, the authors establish the locality in their first description as situated 5.5 km north of the Mesada de los Zaráte (fig. 2). These data are also stated on the holotype's label (fig. 3).

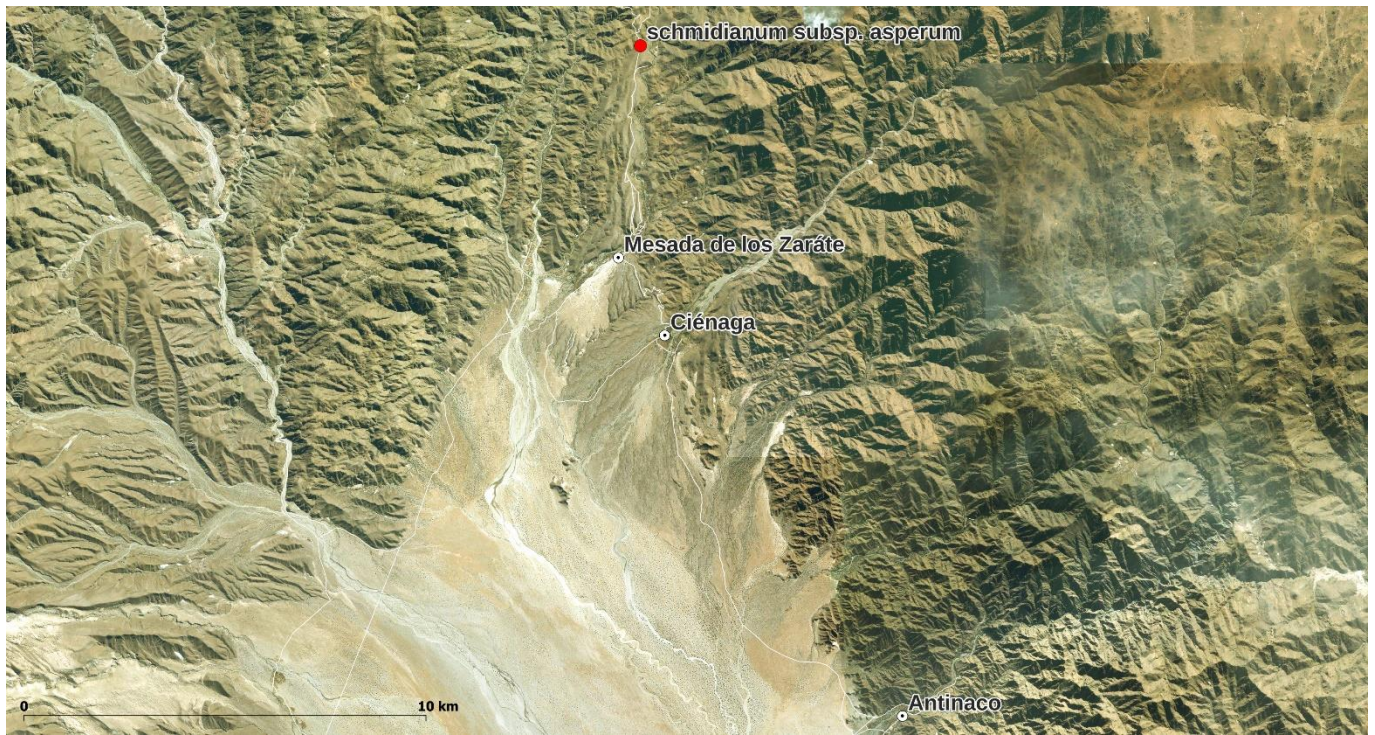


Fig. 2: Type locality of *G. schmidianum* subsp. *asperum*

(basic map: Bing).

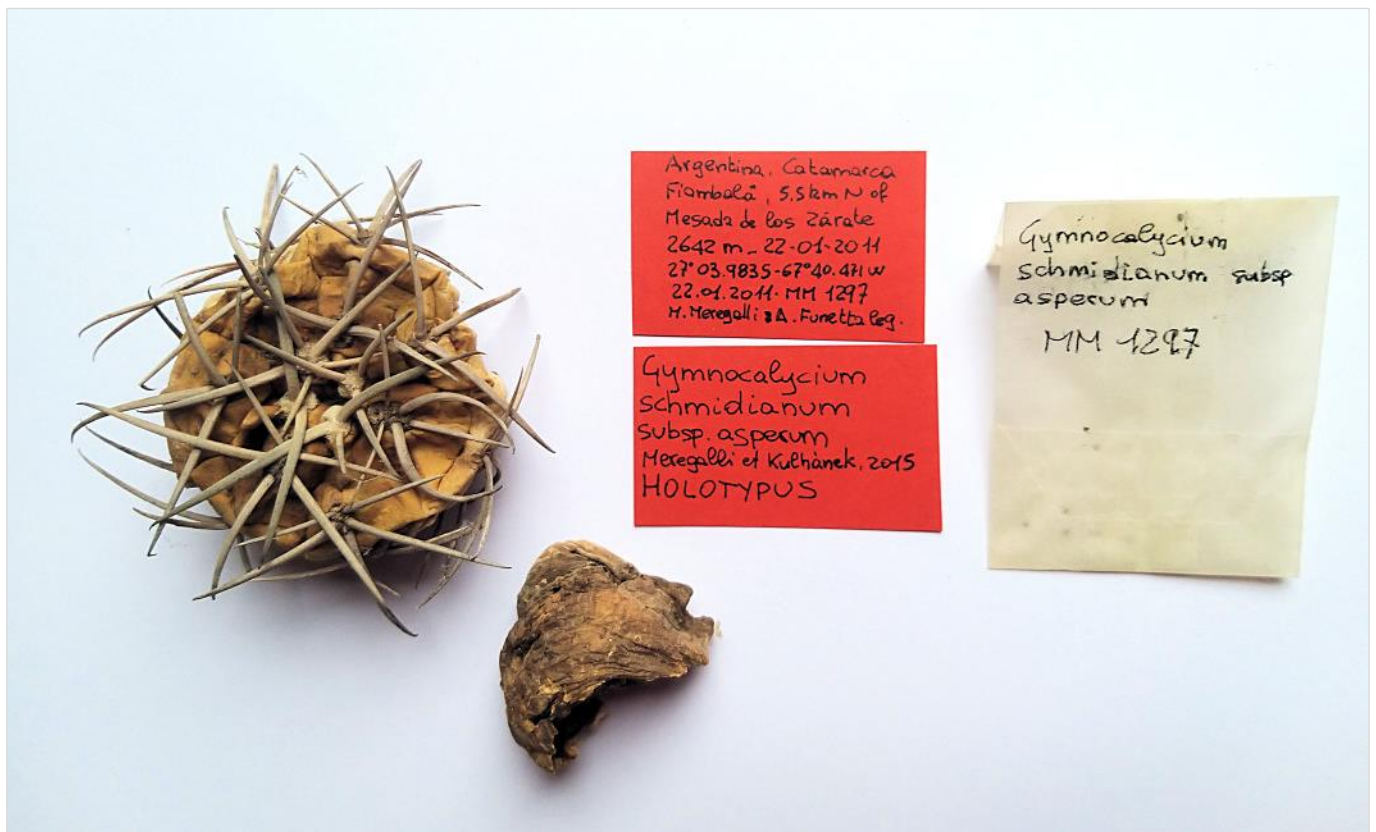


Fig. 3: Holotype of *G. schmidianum* subsp. *asperum* (TO-HG).

2. *Gymnocalycium schmidianum*

G. schmidianum was found at 1,600 m a.s.l. by Franz Strigl on October 18th, 1987, with the field number STO 60. Then still considered a subspecies of *G. catamarcense*, the locality is only vaguely stated as south of Tinogasta in the first description. Hans Till's field notes are not helpful in this respect (fig. 4) as he was ill that day and Franz Strigl had to explore the locality alone (Strigl's personal information).

18.10. Ohne Frühstück in Tinogasta abgefahren. Eine wilde Sucherei bis wir die richtige Ausfallstrasse fanden. Keine Wasser mehr. Aber auch kein Frühstück. Doch dann fanden wir auf der wilden Schotterstrasse, nach mehr als 100 Km ein Geschäft, wo wir Limo und auch Fleischkonserven bekamen. Heute haben wir noch nicht viel gefunden. Vielleicht *Gym hossei var ferox* (60). Wir sind auf dem Weg Famatina Cilesito. Cirka 40 Km vor Famatina, rechts Bergrücken

Fig. 4: Excerpt from Hans Till's field notes of October 18th, 1987.

With the help of Franz Strigl's travel notes the locality of *G. schmidianum*'s first collection can be demarcated relatively well (fig. 5). In personal conversation with Franz Strigl, supported by contemporary modern digital aid, the type locality could be defined accurately.

66: Südlich Tinogasta links der Strasse ein Höhenzug, 1600m, nach beschwerlichem Anmarsch zunächst vergebliches Suchen. Schließlich am Fuße einer Bergrippe wildbedornete *G. hossei v. ferox*, kugelig bis leicht gestrecktkugelig, 12-17 cm Ø, 13-18 cm hoch, z.T. schon abgeblüht, zuweilen mit unreifen blauen Früchten (F 11/35)

61 45 Km nach Tinogasta, an der Grenze Catamarca-La Rioja, *Eps. leucantha*, *Tr. terscheckii*, *Tr. strigosus*, keine *Gymnocalycien*.

Fig. 5: Excerpt from Franz Strigl's travel notes of October 18th, 1987.

The type locality is situated 23 km south of Tinogasta on Ruta Provincial 11 opposite the branch-off to Costa del Reyes and thus about 5.6 km north of the provincial border with La Rioja (fig. 6). The GPS data on the holotype's label are only presumed ones und should be replaced by 28°16.590 S and 67°38.821 E (fig. 7).

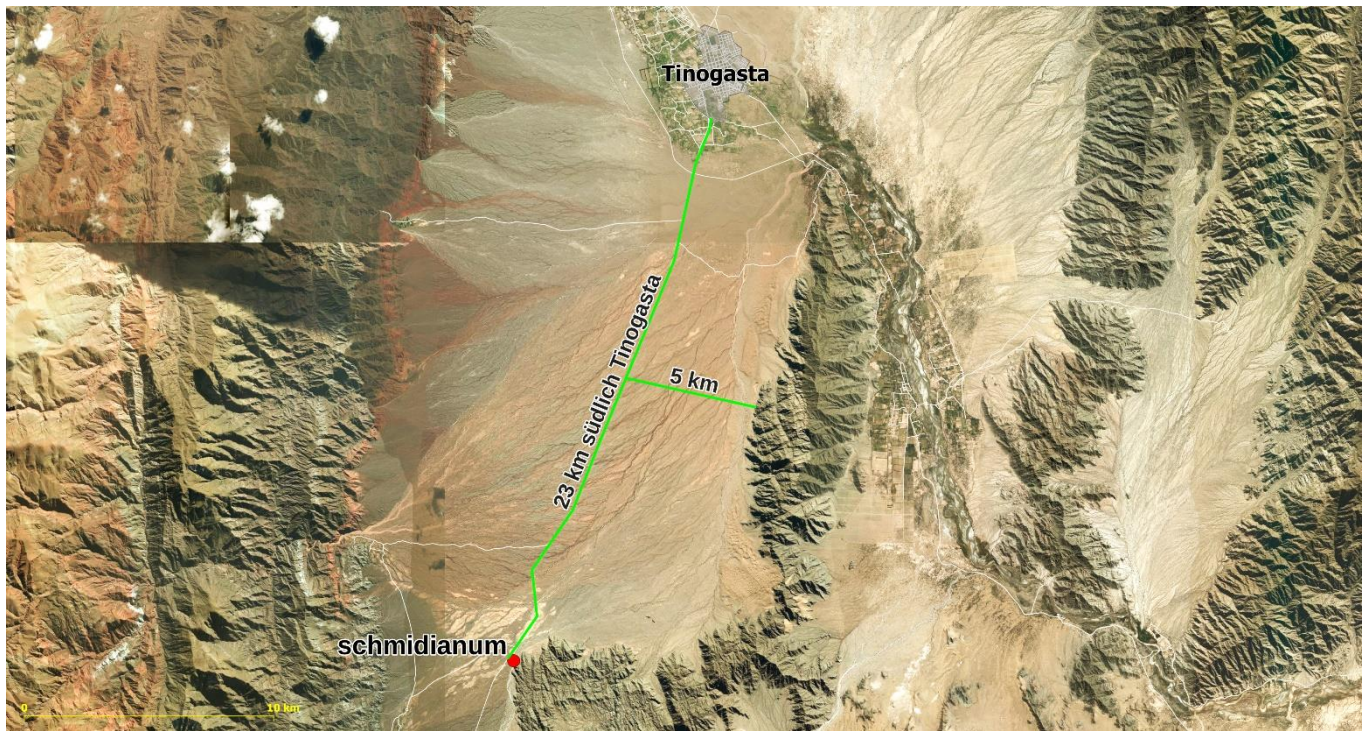


Fig. 6: Type locality of *G. schmidianum*, altitude about 1,500 m a.s.l. (basic map: Bing).



Fig. 7: Holotype of *G. schmidianum* STO 60 in WU (right in EtOH and left flower almost dried out).

3. *Gymnocalycium glaucum*

Gymnocalycium glaucum was found in Province Catamarca southeast of Tinogasta by Friedrich Ritter in February 1959 and in 1963 it was described in the “Schweizer Sukkulentenkunde” (Swiss Succulent Studies). For a long time there were just speculations as to the exact locality. Now the publication of Ritter’s diaries enables us to locate the type locality of *G. glaucum*.

Diary number 42 comprises the travel period between January 28th and February 18th, 1959. The travel notes permit us to exactly retrace Ritter’s travel route during this period (fig. 8). On January 31st he reaches Tinogasta, coming from Hualfin through Cuesta de Zapata. On the next day he continues his journey to Mazan.

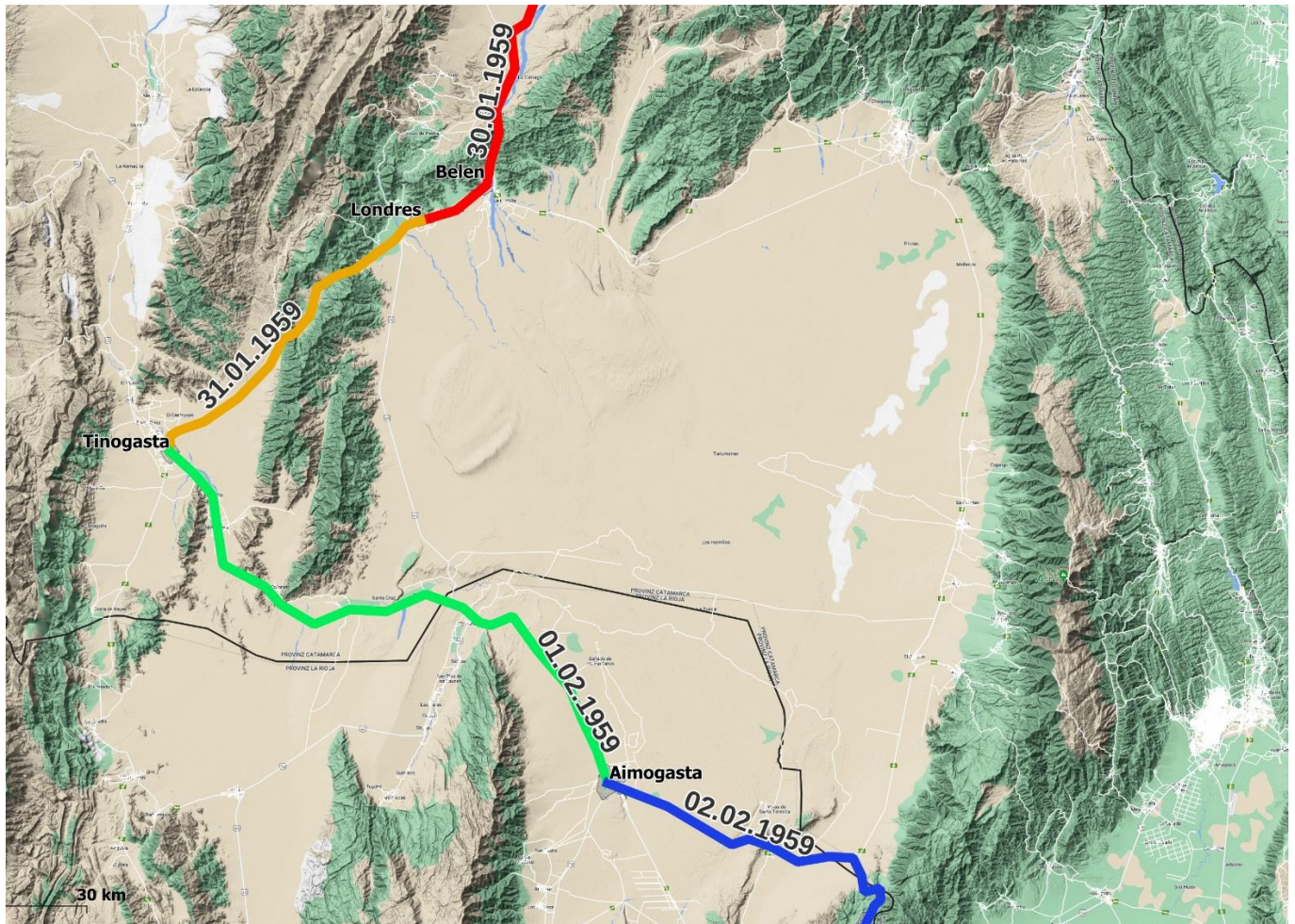
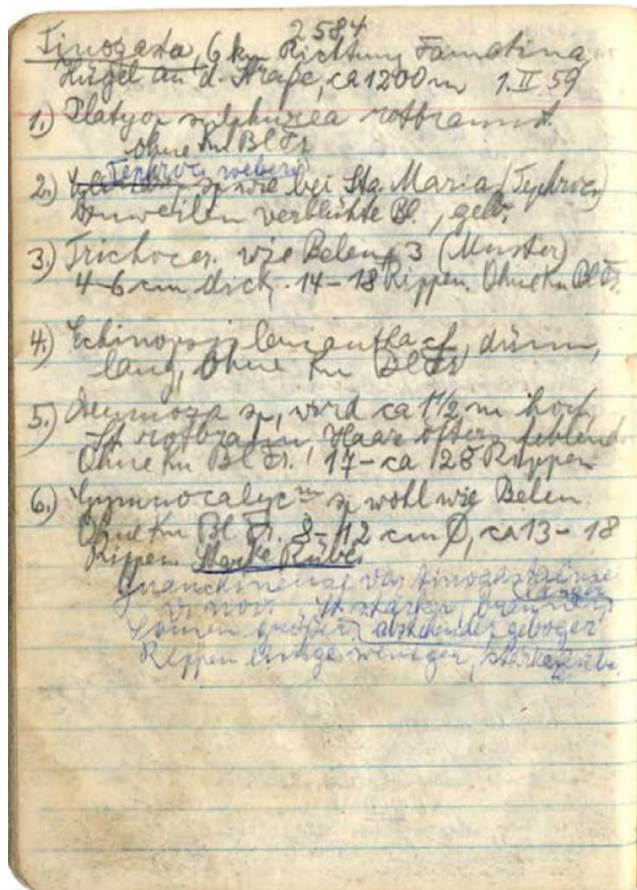


Fig. 8: Ritter’s travel route between January 30th and February 2nd 1959 (basic map: Google).

The first diary entry of February 1st was made 6 km south of Tinogasta (fig. 9). Ritter described the *Gymnocalycium*s found there as similar to those plants he had found on the previous days and considered to be *G. guanchinense*, thus a variety var. *tinogastaense*. This name was not validly published and thus remained a nomen nudum.



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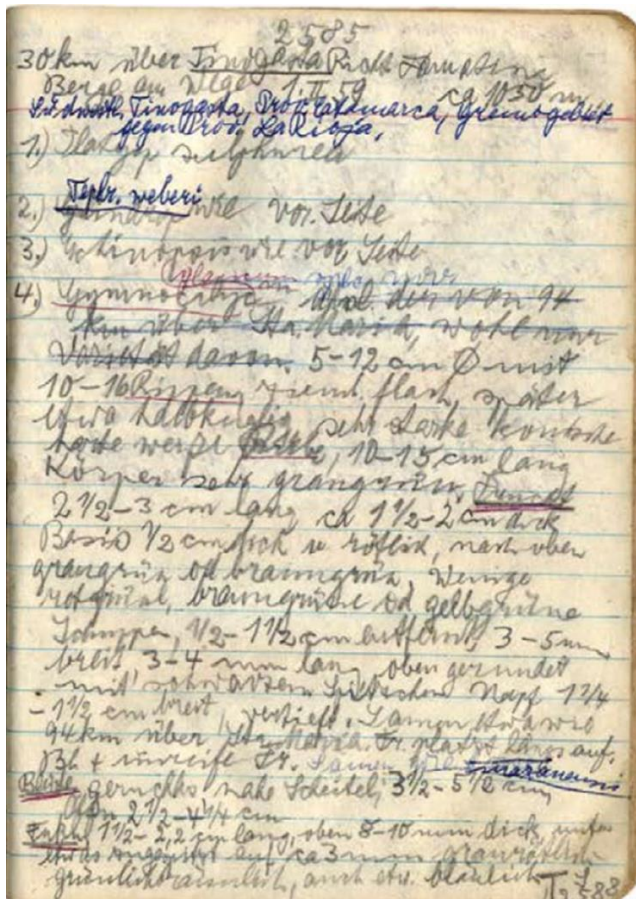
Fig. 9: Facsimile of page 2684 from Ritter's diary No. 42.

The next diary entry took place 24 km onwards at the water gap of Rio Colorado between the southern tip of the Sierra de Vinquis and its separated southern mountain lobe (fig.10). The location mentioned in the first description was presumably added afterwards by Ritter. In doing so he erroneously indicates "southwest of Tinogasta." No locality is mentioned for the holotype (fig. 12).

Tinogasta, 6 km in direction of Famatina, hill on the road, about 1.200 m, 59/2/1

6.) *Gymnocalycium* sp. probably like *Belen*
Without buds, flower, fruit, 8-12 cm Ø, about 13-18 ribs. Pronouncedly beet-shaped.

guanchinense var *tinogastaense* var. nov.
Spines stronger, longer, brownish, more protruding, curved, seed larger, ribs slightly fewer, more pronounced beet.



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30 km away from Tinogasta, in the direction of Famatina, mountains along the way 59/2/1, about 1,050 m southwest of Tinogasta, Prov. Catamarca, border area with Prov. La Rioja

4.) Gymnocalycium glaucum spec. nov. similar to that from 94 km away from Sta Maria, presumably new variety of it. 5-12 cm Ø with 10-16 ribs, rather flat, later somewhat hemispherical, root very pronouncedly cone-shaped, hard, white, 10-15 cm long, body markedly greyish green, fruit 2.5-3 cm long, about 1.5-2 cm wide, base 0.5 cm wide and reddish, towards the top greyish green, often brownish green, few reddish green, brownish green or yellowish green scales, 0.5-1.5 cm apart, 3-5 mm wide, 3-4 mm long, rounded at the top with a small black tip, pit 1.25-1.5 cm wide, recessed. Seeds approximately like 94 km away from Sta Maria. Fruit ripping open longitudinally. Flower and unripe fruit, seeds like mazanensis. Flower without scent, close to the apex, 3.5-5.5 cm, at the top 2.5-4.25 cm.

Ovary 1.5-2.2 cm long, at the top 8-10 mm wide, bottom slightly pointed to about 3 mm, greyish red, greenish brownish, slightly bluish as well.

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Fig. 10: Facsimile of page 2685 from Ritter's diary No. 42.

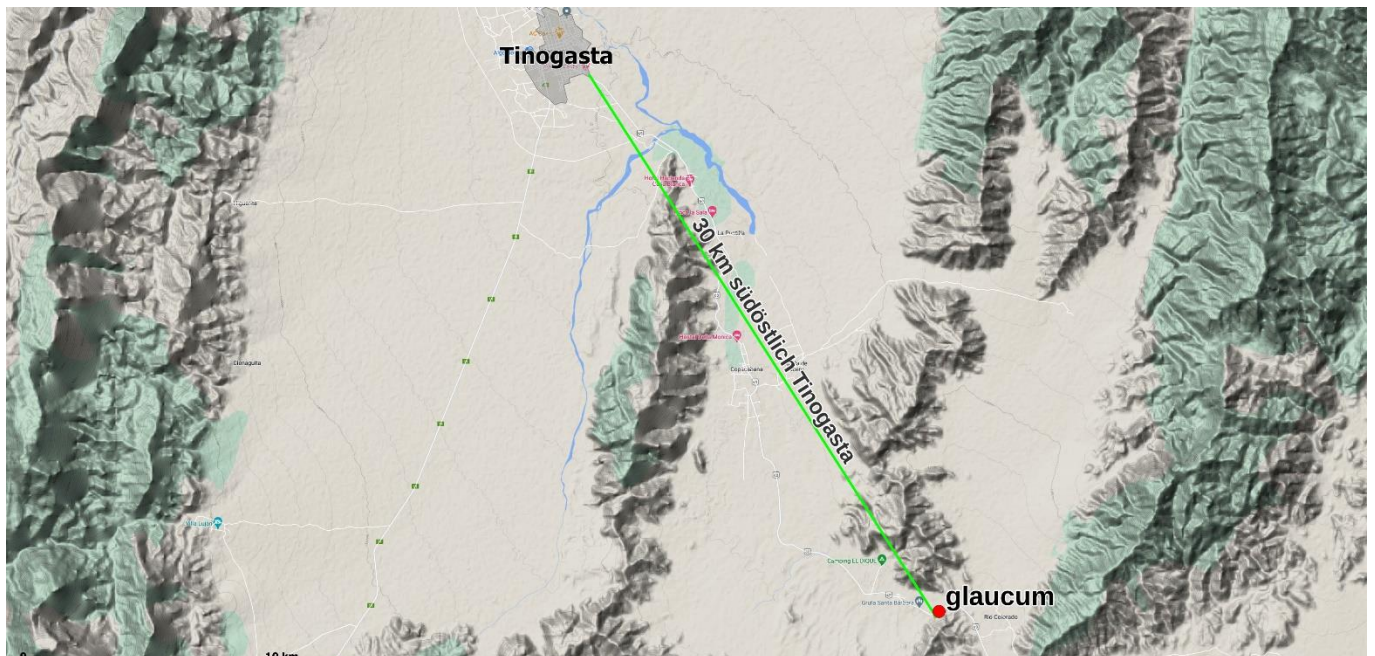


Fig. 11: Type locality of *G. glaucum*. Prov. Catamarca RN 60, 30 km southeast of Tinogasta (basic map: Google).

By means of these notes taken by Ritter the type locality of *G. glaucum* can be determined exactly. It is situated 30 km south of Tinogasta on the RN 60 near Gruta Santa Barbara at 1,050 m a.s.l. (fig. 11). GPS data 28°15.907 S and 67°24.533 E.



Fig. 12: Holotype of *G. glaucum* in the Botanical Museum Utrecht.

SUMMARY

The type localities of *G. glaucum*, *G. schmidianum* and its subspecies *asperum* can be exactly determined with the help of authors' notes. Due to this result the plants from closer or farther localities can be compared with plants from the type localities.

Studies subsequent to this paper were presented at the meeting in Linz by various lecturers and will be published in this magazine.

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