



## NEW RECORDS OF CYANOPROKARYOTES AND ALGAE FROM BRATTNEVET PENINSULA OF LARSEMANN HILLS, EAST ANTARCTICA

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**Abstract:** Brattnevet Peninsula of Larsemann Hills is situated in between the Grovnes and Stinear Peninsula and below the Fisher Island. It comprises water bodies, metamorphosed acidic rocks, and sedimentary rocks. Human activities in this area is promoted by the coastal location, ice free landscape, the further scientific research and the potential for tourist visits may affect the cyanoprokaryotes and algal diversity. The Antarctic environment is highly sensitive and susceptible to the impact of human activities and has much less natural ability to recover from disturbance than the environment of other continents. These changes ultimately affect the growth and diversity of cyanoprokaryotes and algae. Samples were sampled from diverse habitat of Brattnevet Peninsula. Altogether 06 species including Cyanoprokaryotes (03), Bacillariophyceae (02) and Zygnematophyceae (01) were recorded from diverse habitat of Brattnevet Peninsula of Larsemann Hills, East Antarctica. This is the first Indian study report of cyanoprokaryotes and algae of Brattnevet Peninsula of Larsemann Hills, East Antarctica. All the species reported for the first time as new record from this area.

**Keywords:** Algae, Brattnevet Peninsula, Cyanoprokaryotes, Larsemann Hills, East Antarctica.

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### INTRODUCTION

Larsemann Hills (69°23'S, 76°53'E), in the Prydz Bay, is an ice-free oasis on the Ingrid Christensen Coast, Princess Elizabeth Land, located approximately midway between the eastern extremity of the Amery Ice Shelf and the southern boundary of the Vestfold Hills. Larsemann Hills region includes two main peninsulas, the western named Stornes and eastern named Broknes. In

between these two peninsulas, there are some other peninsulas i.e. Grovnes, Brattnevet and Stinear Peninsula and number of islands of varying dimensions and some unnamed promontories. Brattnevet Peninsula is situated in between the Grovnes and Stinear Peninsula and below the Fisher Island at latitude ranging from 69°24'11"S to 69°24'44"S and longitude ranging from 76°14'41"E to 76°16'44"E. There are more than 150 lakes in the



Larsemann Hills (Gillieson *et al.*, 1990), ranging from small ephemeral ponds to large water bodies. Some of these water bodies are ice free for the very short period of time or partially ice free in the summer months when the water temperature increase rapidly, reaching about + 8°C. For the remaining of the year (8 -10 months), they are covered with ice.

Cyanoprokaryotes and algae are photosynthetic organisms, convert solar energy into chemical energy by using sunlight, carbon dioxide, water and minerals that can be utilized by humans and other organisms (Verma and Prakash, 2020). The first primitive form of life called as prokaryotes emerged / originated during 3.5 billion years ago whereas, cyanoprokaryotes (blue-green algae) performing photosynthesis originated during 3.0 billion years ago. It has been uniquely positioned in evolutionary hierarchy of earliest living world, predominantly even during Precambrian era. They are “nature's first and foundational mother and father for causing photosynthesis” and founder of the aquatic food-chain.

Cyanoprokaryotes and algae occur even in wide range of habitats and have been distributed all over land and water system often in such an environments where there is no other vegetation possibly due to their adaptive capability to extreme adverse environmental conditions with respect to different climatic/environmental factors, availability of nutrients, etc. Their occurrence even in wide range of ecologically stress conditions and extreme habitats proves that they are very tolerant (Vincent, 2007). It occurs in fresh-water ecosystem like lakes, ponds, rivers, wetlands, etc. and marine water system like salt marshes and pans, estuaries, brackish waters and ocean. It also occurs on stones, rocks, snow and in cold lakes, thermal springs, acid bogs, alkaline as well as fertile and desert soil, in sub-aerial habitats like tree trunks (bark), epiphytic on aquatic and other plants growing in congenial habitat, benthic and all other objects which remain moisten and get solar light from any angle even for a short span of time.

Cyanoprokaryotes and Algal diversity and distribution in the Larsemann Hills, East Antarctica is not well known, except a few

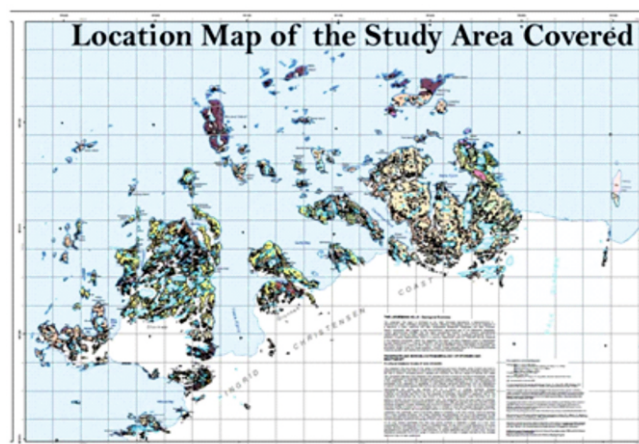
species of cyanoprokaryotes, diatoms and dinoflagellates from freshwater lakes and marine habitats of Prydz Bay (Sabbe *et al.*, 2003; Taton *et al.*, 2006a; 2006b; Taton *et al.*, 2011) and from Stinear Peninsula and Broknes Peninsula (Gupta 2019; 2021a and 2021b). The studies on cyanoprokaryotes and algal diversity from Brattnevet Peninsula of Larsemann Hills, East Antarctica have so far not been undertaken. Keeping this in the view, an attempt has been made to study the factual cyanoprokaryotes and algal profile from Brattnevet Peninsula of Larsemann Hills, East Antarctica.

## MATERIALS AND METHODS

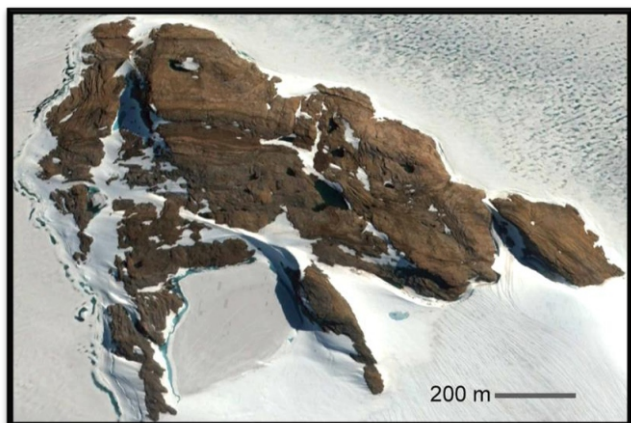
The author participated in the Indian Scientific Expedition to Antarctica (ISEA) to carry out cyanoprokaryotes and algal diversity studies in Brattnevet Peninsula of Larsemann Hills, East Antarctica during the austral summer and surveyed the same.

### Study Area and Sample Collection:

During the XXXIII Indian Scientific Expedition to Antarctica (ISEA), cyanoprokaryotes and algae were observed in the Brattnevet Peninsula of Larsemann Hills, East Antarctica (Fig. 1, 2). Samples were sampled from water bodies by towing Plankton Net and preserved by adding 2 to 3 drops of preservative in screw cap sampling vials of Tarsons (size 25X50mm & 25X75mm). Specimen vials were marked by glass marker about sample number, location, type of water bodies and date of collection and deposited in the Ecology Section of Central Botanical Laboratory, Botanical Survey of India, Howrah (CAL).



**Fig. 1: Location Base Map of Larsemann Hills, East Antarctica**



**Fig. 2: Satellite Imagery Map of Brattnevet Peninsula of Larsemann Hills, East Antarctica.**

### Observation and Identification:

Specimens observed under Leica DM 2500 Microscope. The photomicrographs of each specimen were taken by DFC 500 digital camera with annotation using Leica QWin V 3.2 Image Processing and Analysis Software and Leica Application Suit V4 Software. Specimens were identified by consulting standard reference books, monograph (Geitler, 1932; Tiffany and Britton, 1952; Desikachary, 1959; Prescott, 1982; Anand, 1998; Kant and Gupta, 1998; Komárek and Anagnostidis, 2005; Guiry and Guiry, 2023) and taxonomic enumerations was done. The authority name of each species is cited in the text as described in "Authors of Plant Names" (Brummitt and Powell, 1992), whereas Journals, Periodicals with Botanical content as described by Bridson (2004a;2004b).

## RESULTS

### Systematic Enumeration:

Systematic studies provide basic information on the cyanoprokaryotes and algal diversity from diverse habitats of Brattnevet Peninsula of Larsemann Hills, East Antarctica. Taxonomic enumeration of identified cyanoprokaryotes and algae are described here along with their details including nomenclature.

Cyanophyceae

Nostocales

Nostocaceae

*Nostoc* Vaucher ex Gomont

*Nostoc linckia* Bornet ex Bornet & Flahault, Ann. Sci. Nat. Bot. ser. 7(7): 192, 1886; Desikachary, Cyanophyta 377, t. 69, f. 4. 1959.

Colony firm and first globose, later irregularly expanded, membranous, blue-green, becoming dirty-green; trichome loosely entangled, flexuous or coiled, more or less twisted; cells short, sub-globose or barrel shaped; heterocysts sub-spherical (Fig. 3).

Dimension: Trichome 3.6 - 4.4  $\mu\text{m}$  broad; heterocyst 4.8 - 5.8  $\mu\text{m}$  broad.

Environment: Freshwater.

*Nostoc punctiforme* Har., J. Bot. 5: 31, 1891; Prescott, Algae of the Western Great Lakes Area 525, t. 121, f. 4. 1982.

Colony globose, sub-globose or sometimes ovate; trichome in colourless mucilage; more or less linear arrangement of the cells; cells compressed-globose to barrel shaped, cell contents blue-green to greyish blue-green; heterocysts globose or compressed globose (Fig. 4).

Dimension: Trichome 3.3 - 4.0  $\mu\text{m}$  broad; heterocysts 4.5 - 5.6  $\mu\text{m}$  broad.

Environment: Freshwater.

Oscillatoriales

Oscillatoriaceae

*Phormidium* Kütz. ex Gomont

*Phormidium subfuscum* Kütz. ex Gomont, Kütz., Phycol. general. 195, 1843; Tiffany & Britton, The Algae of Illinois 332, t. 90, f. 1044. 1952. Desikachary, Cyanophyta 273, t. 44, f. 22 - 23. 1959.

Trichome straight, blue-green or sometimes olive-green, not constricted at the cross-walls, generally cross-walls granulated, slightly narrow apically, sometimes sub-quadrate; end more or less briefly attenuated, capitate; end cells straight, acute-conical (Fig. 5).

Dimension: Trichome 5.4 - 11.0  $\mu\text{m}$  broad and cells 2.1 - 3.9  $\mu\text{m}$  long.

Environment: Freshwater.

Bacillariophyceae

Bacillariales

Bacillariaceae

*Hantzschia* Grunow

*Hantzschia amphioxys* f. *capitata* O. Müller, Bot. Jahrb. 43: 34, t. 2, f. 26. 1909; Tiffany & Britton, The Algae of Illinois 289, t. 75, f. 887. 1952.

Valve narrowly linear-lanceolate, dorsal side convex, ventral side slightly concave with distinct deep median depression; ends slightly



attenuated, constricted rounded capitate; keel punctae distinct, slightly thick, slightly elongated; striae fine, lineate, parallel throughout the valve (Fig. 6).

Dimension: Cells 10.0 - 12.7  $\mu\text{m}$  broad and 84.0 - 99.0  $\mu\text{m}$  long; striae 20 - 22 in 10  $\mu\text{m}$  and punctae 6.0 - 8.0 in 10  $\mu\text{m}$ .

Environment: Freshwater.

Naviculales  
Naviculaceae  
*Navicula* Bory

*Navicula cryptocephala* Kütz., Bacillarien. 95, t. 3, f. 20 & 25. 1844; Prasad & Srivastava Freshwater algal flora of Andaman and Nicobar islands 1: 204, t. 29, f. 2. 1992. Krammer & Lange-Bertalot, Bacillariophyceae Part 1: Naviculaceae 2/1: 502, f. 31: 14. 1997.

Valves linear lanceolate with constricted more or less capitate ends, raphe thin, straight median with distinct central nodules; Central area elongated and somewhat rounded; striae lineate, slightly short in central area (Fig. 7).

Dimension: Cells 7.0 - 9.0  $\mu\text{m}$  broad and 32.0 - 38.0  $\mu\text{m}$  long; striae 14.0 - 16.0 in 10  $\mu\text{m}$ .

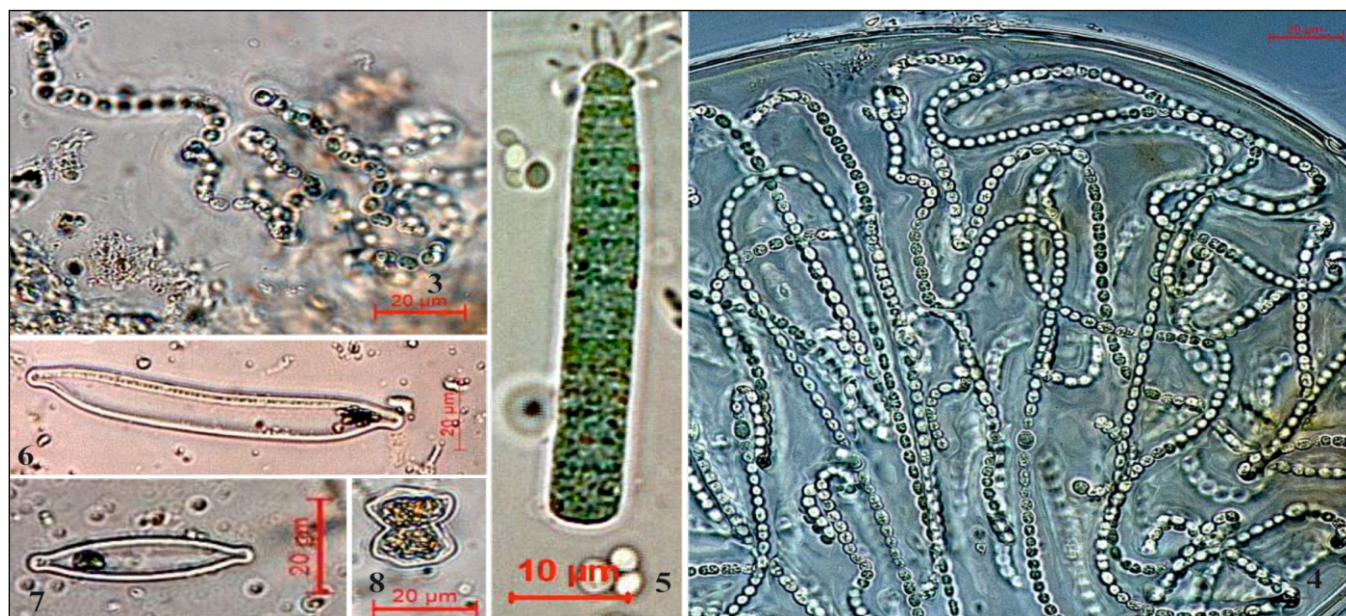
Environment: Freshwater marine species.

Zygnematophyceae  
Desmiales C.E.Bessey  
Desmidiaceae Ralfs  
*Staurastrum* Meyen ex Ralfs

*Staurastrum margaritaceum* Menegh. ex Ralfs, Brit. Desmids 134, t. 21, f. 9 a - e. 1848; Tiffany & Britton, The Algae of Illinois 200, t. 54, f. 599. 1952. Cells about as long as wide or sometimes longer, constriction shallow, sinus open; semi-cells variable, cup-shaped, sub-spherical or sub-fusiform, upper angles produced to short, obtuse, horizontal or sometimes convergent processes; cell-wall sides concave, center of apex smooth, angles produced to short, truncate, spineless but often emarginated processes (Fig. 8).

Dimension: Cells 15.8 - 20.0  $\mu\text{m}$  broad and 19.5 - 26.0  $\mu\text{m}$  long; isthmus 7.0 - 12.5  $\mu\text{m}$  wide.

Environment: Freshwater.



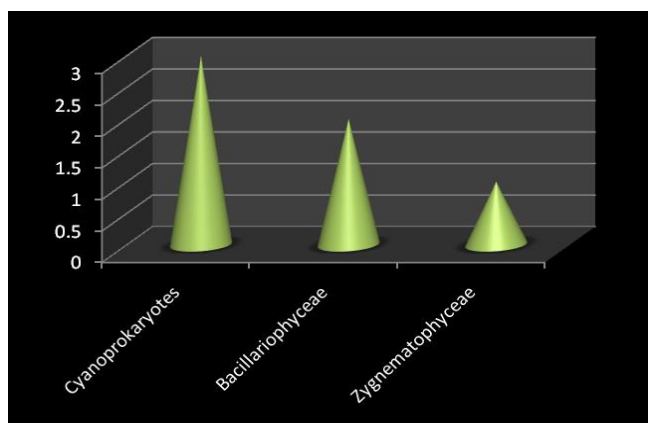
**Figs. 3-8: Cyanoprokaryotes and Algae first reported from Brattnevet Peninsula of Larsemann Hills, East Antarctica.** 3. *Nostoc linckia* Bornet ex Bornet & Flahault, 4. *Nostoc punctiforme* Har., 5. *Phormidium subfuscum* Kütz. ex Gomont, 6. *Hantzschia amphioxys* f. *capitata* O. Müller, 7. *Navicula cryptocephala* Kütz. and 8. *Staurastrum margaritaceum* Menegh. ex Ralfs

## DISCUSSION

During exploration of cyanoprokaryotes and algae carried out at Brattnevet Peninsula of Larsemann Hills, East Antarctica, altogether six

species belonging to Cyanoprokaryotes (03), Bacillariophyceae (02) and Zygnematophyceae (01) were identified and depicted in Fig. 9. Maximum number of species were of

Cyanoprokaryotes viz. *Nostoc linckia* Bornet ex Bornet & Flahault, *Nostoc punctiforme* Har. and *Phormidium subfuscum* Kütz. ex Gomont observed followed by 02 species of Bacillariophyceae viz. *Hantzschia amphioxys* f. *capitata* O.F. Müller, *Navicula cryptocephala* Kütz. and 01 species of Zygnematoophyceae viz. *Staurostrum margaritaceum* Menegh. ex Ralfs (Fig. 9).



**Fig. 9: Class wise species distribution in study area.**

All the species described here are reported for the first time from Brattnevet Peninsula of Larsemann Hills, East Antarctica as new record because this is the first study report of cyanoprokaryotes and algal diversity observed from Brattnevet Peninsula.

## CONCLUSION

Cyanoprokaryotes and algal biogeography in Antarctica offers many challenges and opportunities to study the nature and rates of adaptation of different groups of algae in such a harsh climatic condition. There is lots of scope for further studies to understand the endemism, phylogeny and adaptive strategies to thrive in this extreme harsh climatic condition. All these species reported for the first time from Brattnevet Peninsula of Larsemann Hills, East Antarctica as new record. The Antarctic environment is highly sensitive and susceptible to the impact of human activities and has much less natural ability to recover from disturbance than the environment of other continents.

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