A Mesoporous Pattern Created by Nature in Siliceous Spicules from Marine Sponges.

G. Croce, D. Viterbo, M. Milanesio, H. Amenitsch

£ DISTA, Univ. del Piemonte Orientale, Via V. Bellini 25 G, I-15100 Alessandria, Italy
$ Inst. of Biophysics, Austrian Acad. of Science, Schmiedlstr. 6, A-8043 Graz, Austria

mailto: gianluca.croce@mfn.unipmn.it
http://materialchemistry.dista.unipmn.it/

VIII Scuola SNLS – Frascati 10-21 Ottobre 2005
Section: 20

Lenght: 2-2.5 mm
Section: 20 μm
• Calcareous or siliceous material
• Cellular secretion due to specialized cells (Sclerocytes)
• Two kinds of spicules:
  • Megascleres (sponge skeleton)
  • Microscleres (ancillary function)
• Presence of a channel along the elongation axis of megasclere spicules
• Spicules generally contain an organic filament inside their cavity
• Silicateins are the proteins in the filament and are important for the bioprocessing of silica

**Characterization**

**EDS Analysis**
reveals the inorganic envelope

**TGA and FTIR Analyses**
reveal the organic matter
SAXS Experiments

Bundle of oriented Spicules

“Powder” of non oriented Spicules

Single Spicule

Temperature Dependence
Temperature Dependence

- Spots too sharp for a fibre!
- The arrangement must be more ordered and complex…
Temperature Dependence (II)

25°C

250°C
♦ Conclusion

• A high degree of order is present in the organization of the protein units (known as Silicatein) forming the central filaments.

• The protein units, hosted inside the spicule cavities, have different packing in spicules from different sponge families.

• The arrangement of the Silicatein units is similar to that of the pores in highly ordered siliceous mesoporous materials.

• Silicatein units act as SDA for the formation of an highly organized inorganic nanostructure.