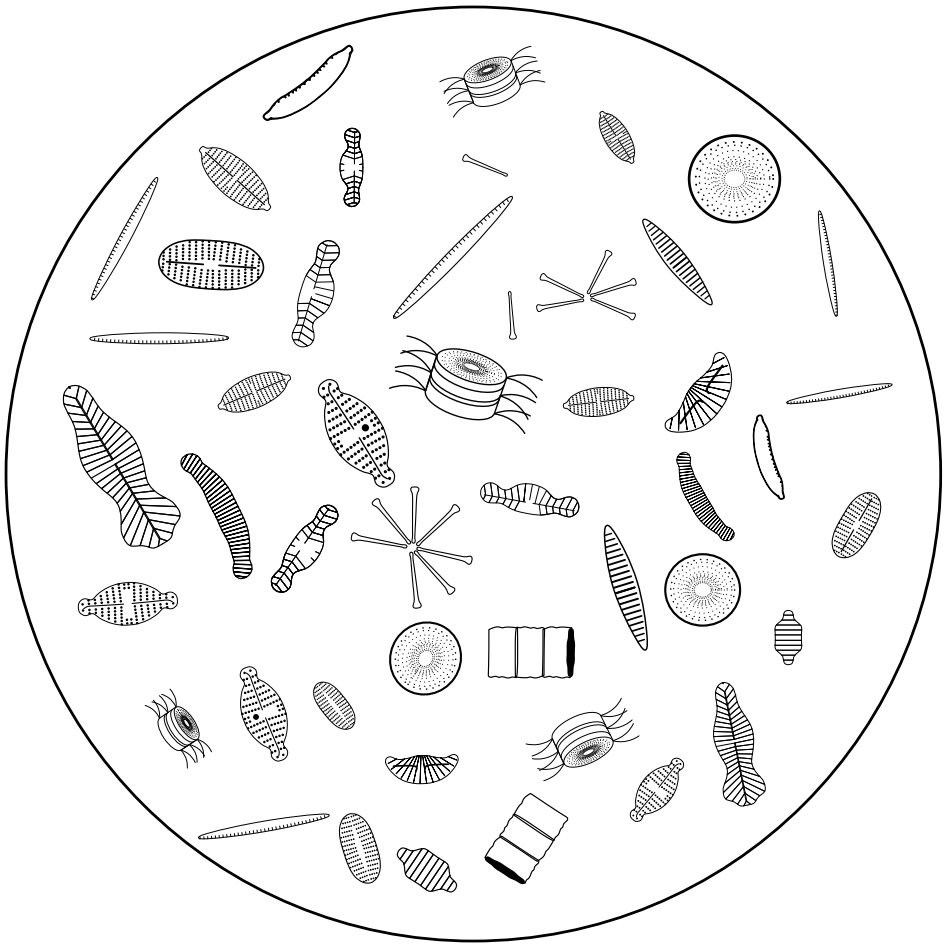


Forensic Diatomology Guide

GLOSSARY OF TERMS APPLICABLE TO DIATOMS

theca – a fragment of the shell corresponding to the upper or the lower part

epitheca / hypotheca – upper, bigger / lower, smaller part of the shell

epivalve / hypovalve – upper / lower base of the theca (epitheca / hypotheca)

apical axis – longer axis

transapical axis – shorter axis at right angle to apical

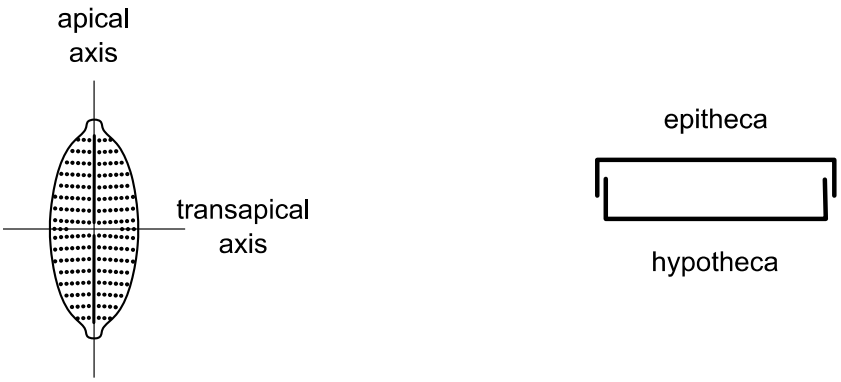
raphe – longitudinal slit through the valve of some diatoms associated with motility

pores – perforations in a shell wall

striae – characteristic lines formed by rows of fine holes or cuts

stigma – an isolated pore distinguished from others, located in the central area

girdle band – a belt connecting both valves



Figs 1, 2. Valve (front) and girdle view of a diatom shell (modified by Round *et al.* 1990).

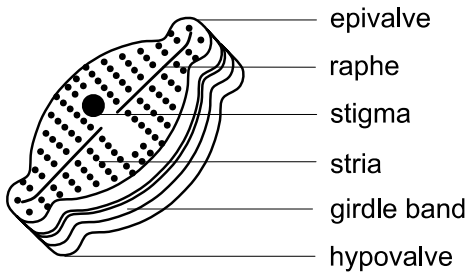


Fig. 3. Oblique view of a diatom shell (modified by Round *et al.* 1990).

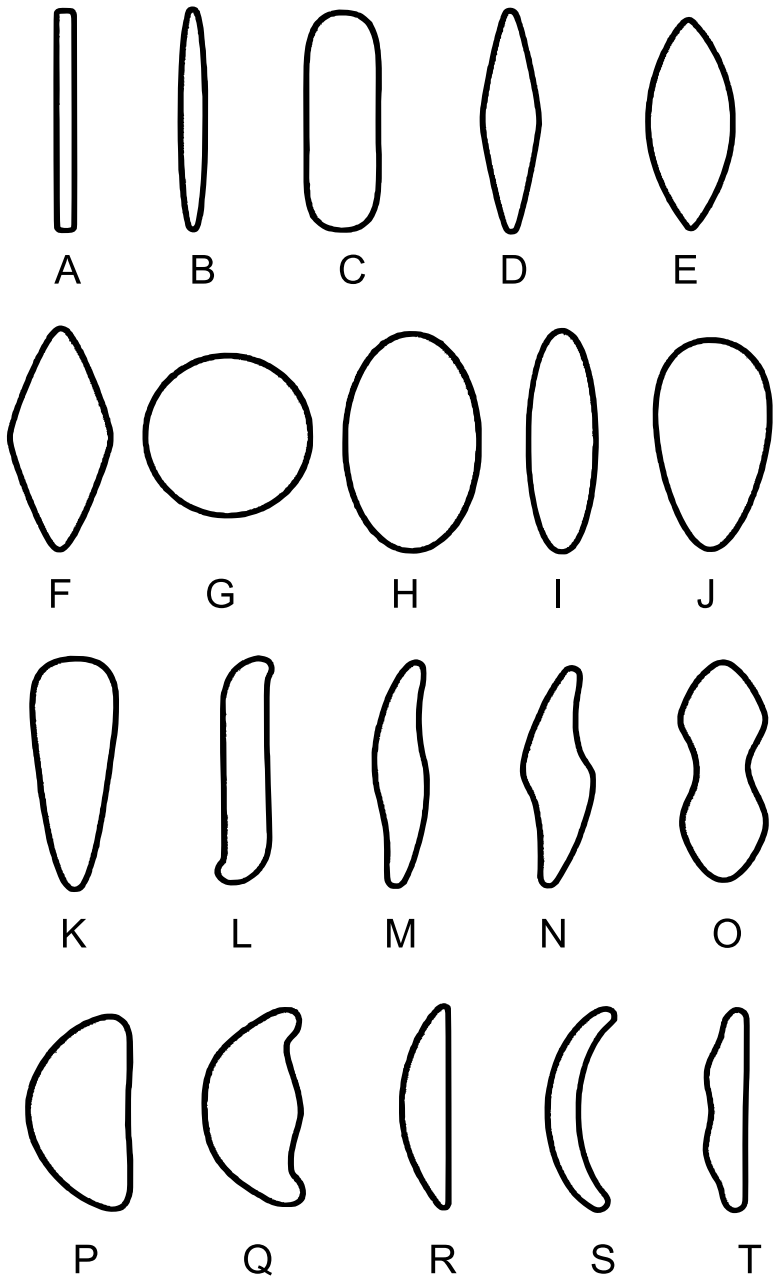


Fig. 4. Typical valve shapes in dorsal view (modified from John 2012).

A. linear, narrowly cylindrical
B. linear, lanceolate
C. linear, oblong
D. linear rhombic
E. lanceolate
F. rhombic
G. orbicular (circular)
H. elliptical

I. oblong
J. ovate
K. clavate
L. sigmoid cylindrical
M. sigmoid lanceolate
N. sigmoid rhombic
O. panduriform
P. semi-circular, dorsiventral
Q. semi-circular with tumid apices
R. semi-lanceolate dorsiventral
S. lunate arcuate; dorsiventral
T. semi-lanceolate-undulate

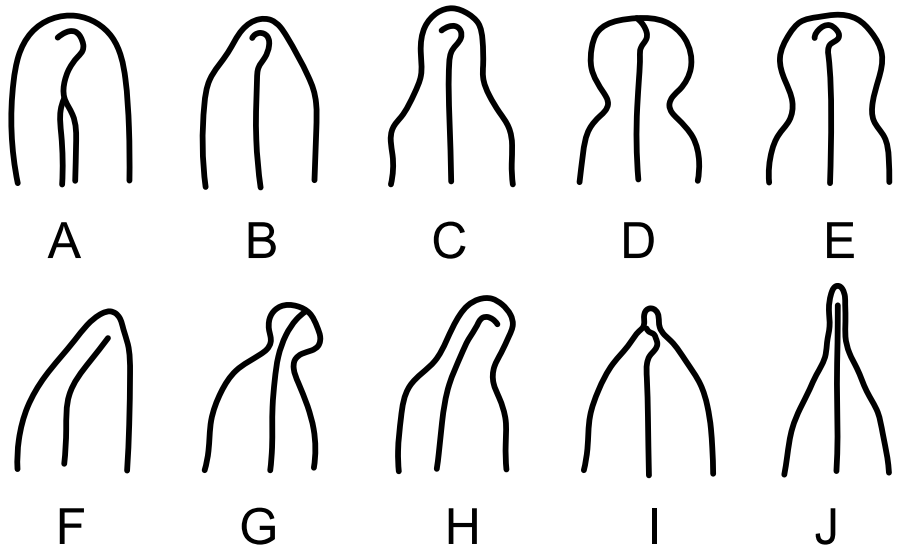


Fig. 5. Shapes of valve apices in dorsal view (modified from John 2012).

A. obtuse, rounded
B. cuneate
C. rostrate
D. capitate
E. sub-capitate
F. obliquely cuneate
G. obliquely capitate
H. sigmoid, rostrate
I. acuminate
J. apiculate

Table 1. Overview of typical diatom characteristics for selected genera and species.

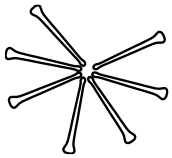
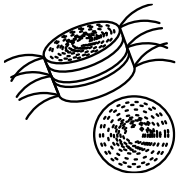
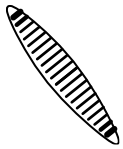
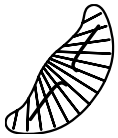
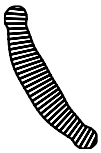
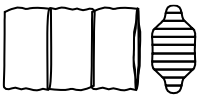
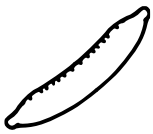
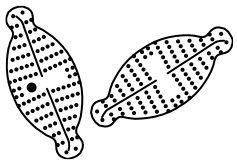
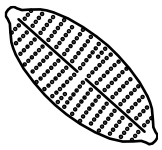
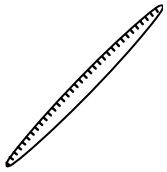
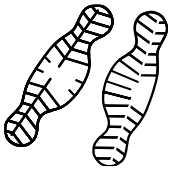
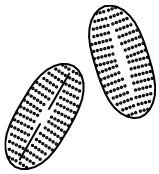
species	cell organisation	raphe	valve shapes	valve apices	illustration
Asterionella sp.	star-like colonies	none	apically symmetric, linear	capitate, expanded	
Chaetoceros sp.	chain-formed colonies	none	radially symmetric, circular	-	
Denticula sp.	single	along the edge	apically and transapically symmetric, linear, lanceolate, linear elliptic	rounded	
Encyonema sp.	single	present on both valves	transapically symmetric, semi-circular, semi-lanceolate	rounded	
Eunotia ambivalens	single	reduced	transapically symmetric, linear, lunate arcuate	capitate, rounded	
Fragilaria sp.	ribbon-like colonies	none	apically and transapically symmetric, linear, linear lanceolate	capitate, rounded, rostrate	
Gomphonema acuminatum	colonies	present on both valves	apically symmetric, clavate	rounded, obtuse	

Table 1. Overview of typical diatom characteristics for selected genera and species (continued).

species	cell organisation	raphe	valve shapes	valve apices	illustration
Hantzschia abundans	single	along the edge	transapically symmetric, linear lanceolate	acuminate	
Luticola permuticopsis	single	present on both valves	apically and transapically symmetric, linear, elliptic, lanceolate	rounded, capitate	
Navicula gregaria	single	present on both valves	apically and transapically symmetric, linear, linear lanceolate	capitate, rostrate	
Nitzschia sp.	single, rarely chain-formed colonies	along the edge	apically and transapically symmetric, narrow, lanceolate	acuminate, capitate	
Planothidium capitatum	single	only on one valve	transapically symmetric, linear elliptic, lanceolate	capitate, rounded	
Psammothidium papilio	single	only on one valve	apically and transapically symmetric, elliptic, linear elliptic	obtuse, rounded	

***Asterionella* sp.**

Cells form star-like colonies. Valves are apically symmetric and transapically asymmetric, linear with capitate, slightly expanded poles. One is slightly smaller than the other. The valve face is finely striate. The striae are porous. This genus belongs to common plankton in many freshwater lakes.

***Chaetoceros* sp.**

Shells united to form straight chains. Many discoid plastids could be observed in the cells. Valves are circular, radially symmetric. There are two hair-like structures on each valve. This is a marine genus, common in estuaries but some species do occur in high conductivity or saline waters.

***Denticula* sp.**

Cells single, valves apically and transapically symmetric, linear-lanceolate or linear-elliptic with rounded poles. Raphe is acentric, difficult to observe, because it is situated on valve margins. Striae fine, made of small poroids. This is a freshwater genus and occurs is low-nutrient environment (oligotrophic).

***Encyonema* sp.**

Cells usually solitary. Valves are apically asymmetric and transapically symmetric (cymbelloid shape), semi-circular or semi-lanceolate. Endings are rounded or rostrate. Raphe short, acentric, out of cell axis. Striae slightly radial, made of poroids. Isolated stigma may be present lateral to the central area. The genus is abundant in freshwater bodies.

Eunotia ambivalens

Cells mostly single. Valves apically asymmetric and transapically symmetric, linear and lunate arcuate with rounded or capitate apices. A small raphe at the poles is not visible in valve view. This genus is common in unpolluted freshwater bodies.

***Fragilaria* sp.**

Shells joined to form ribbon-like colonies linked through margins. Valves are apically and transapically symmetric, linear, linear-lanceolate, elliptical with capitate, rounded or rostrate endings. Raphe is not present. This is predominantly a freshwater genus.

Gomphonema acuminatum

Cells colonial with branched mucilaginous stalk. Valves are apically symmetric and transapically asymmetric, clavate – head pole is broader than a foot pole. Valve apices are capitate to apiculate. Raphe central and terminal fissures slightly curved. Striae are radial to parallel. Stigma often present lateral to the central area. A freshwater epiphytic genus common in streams.

Hantzschia abundans

Cells solitary. Valves apically asymmetric and transapically symmetric are slightly sigmoid or linear-lanceolate with rostrate or apiculate poles. Raphe is located only on one margin, both raphes are on the valve margins of the same side of the shell. Striae made of simple rows of pores parallel, interrupted at the centre, raphe endings simple. It is common in damp soil and streams especially with eroded soil sediments.

Luticola permuticopsis

Cells single, apically and transapically symmetric from valve view. Valves linear, lanceolate or elliptical with rounded and capitate ends. Distinct isolated pore (stigma). Raphe endings slightly curved. Striae slightly radiate with clear simple widely spaced pores. This is a distinct freshwater genus and a good indicator of slightly acidic and relatively pristine, low conductivity waterbodies.

Navicula gregaria

Cells single. Valves are apically and transapically symmetric, linear, or linear-lanceolate with rostrate or capitate or blunt ends. Striae arranged transversely in single or double rows, parallel or radiate. This species commonly occurs in freshwater bodies.

***Nitzschia* sp.**

Cells usually solitary or rarely in chain. Two plastids are located one on each end of the valve. Valves are apically and transapically symmetric, mostly straight, narrow, linear, lanceolate with rostrate or capitate ends. Raphe is strongly acentric located on one margin. Raphe system on the two valves on opposite margins. Striae simple, mostly parallel, in most of the species, striae cannot be easily resolved under light microscope. This is a difficult genus to identify to the species level and is represented by several marine and freshwater species tolerant to pollution. Present in damp soil and common in streams with sediments from erosion.

Planothidium capitatum

Cells occur solitary, valves apically asymmetric and transapically symmetric, slightly expanded in the middle, linear-elliptic, lanceolate with rounded and capitate ends. Raphe is present only on one of valves (heterovalval genus). Raphe straight and simple. Striae are fine, slightly radiate. This genus is distributed in both fresh and brackish waters.

Psammothidium papilio

Cells solitary. Valves apically and transapically symmetric, elliptical to linear elliptical with obtuse apices. Raphe is present only on one of valves (heterovalval genus). Striae is dense and raphe less valve have different number of striae and striae structure than valve with raphe. This is a freshwater genus and its presence is often restricted to sand sediments.

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Illustration of diatoms on the front page and in the table: author.