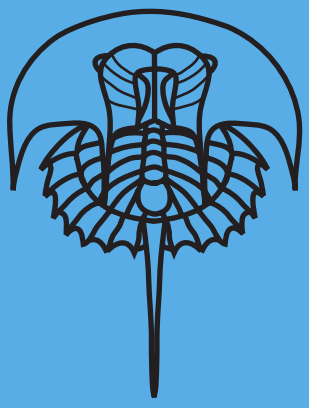

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Part T, Revised, Volume 1, Chapter 6: Glossary of Patterns, Abbreviations, and Symbols Used to Designate Crinoid Morphology

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PART T, REVISED, VOLUME 1, CHAPTER 6: GLOSSARY OF PATTERNS, ABBREVIATIONS, AND SYMBOLS USED TO DESIGNATE CRINOID MORPHOLOGY

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Symbols, abbreviations, and other designations are used minimally in this volume. Although they can add clarity to descriptions and diagrams, because the same abbreviations have been used historically for different anatomical features, they can be confusing to anyone other than the author. Thus, usage of most of the abbreviations and symbols listed below is discouraged because of potential confusion, and because it adds further jargon, making the terminology of crinoids even more opaque for the beginning student and others. It is also the policy of the *Treatise on Invertebrate Paleontology* to avoid abbreviations where possible. Nevertheless, these abbreviations and symbols are a part of the crinoid literature and therefore, a listing is given below.

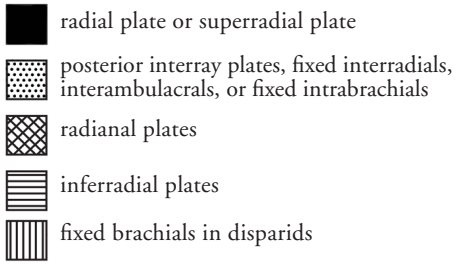
Patterns and abbreviations presented herein include shading and patterns for select calyx plates, designation of rays using the Carpenter ray system (Carpenter, 1884 in 1884–1888), designation of certain posterior plates, a scheme to describe heteromorphic columns (Webster, 1974), and a scheme to describe fixed interray plating (Ausich & Kammer, 1991). For some highly unusual taxa, such as the Calceocrinidae, unique abbreviations may also be used.

Five patterns are used to designate specific calyx plates, as noted in Table 1.

Following the Carpenter ray system (Carpenter, 1884 in 1884–1888), the letters A, B, C, D, and E designate rays; and, correspondingly, AB, BC, CD, DE, and EA designate interrays. A is the anterior, and CD is the posterior. Two important posterior interray plates are commonly designated with letters on plate diagrams: P for the primanal and X for the anal X plate.

Webster (1974) introduced a scheme to designate the cycles of internodal plates in a heteromorphic column. N212 indicates a column with a nodal (N), priminternodal (1), and secundinternodals (2). A subsequent nodal is assumed after this sequence. With the exception of the proximal-most interradial plates, specific names for individual fixed interradial plates are not recommended (Ausich & Kammer, 1991). Instead, a shorthand indication of the number of plates in progression from proximal to distal is recommended. For posterior interrays in camerate crinoids with fixed plates, P-3-2-1 indicates the primanal (P) followed by a range with three plates, a range with two plates, and a final range with one plate. For fixed regular interrays, 1-2-4-5 indicates the first interradial plate (1) followed by a range with two plates, a range with four plates, and a final range with five plates.

Table 1. Patterns used in plate diagrams to designate important calyx plates.



Ausich, William I. 2021. Part T, Revised, Chapter 6: Glossary of patterns, abbreviations, and symbols used to designate crinoid morphology. Treatise Online 145:1–5.

Historically, various other abbreviations and symbols have also been used to denote specific plates, parts, articulations, or orientation directions of the crinoid endoskeleton. In some instances, an abbreviation is used by different authors for different skeletal features or different abbreviations are used for the same feature, which has led to confusion. BATHER (1900) proposed the first of these schemes, but there have been many revisions and changes of usage since 1900. LANE (1978) summarized symbols applied to crinoid morphology, and ROUX, MESSING, and AMÉZIANE (2002) summarized abbreviations commonly used for extant crinoids.

Below is a listing of more commonly used morphological abbreviations in crinoid literature. The list was initially compiled by N. GARY LANE for the Part T *Treatise* volume (1978, p. 243–244). This revised list includes the LANE list with minor modifications plus the addition of more symbols. LANE (1978) compiled these from the references cited below, and letters in parentheses after an abbreviation or symbol indicates the source, which is noted after each abbreviation in the following lists. Additional references are also added as appropriate.

Sources for these abbreviations include:
AUSICH, 1996 (WIA)
AUSICH & KAMMER, 1991 (AK)
AUSICH & others, 2020 (AWCS)
BATHER, 1900 (Ba)
BRETT, 1981(Ba)
CARPENTER, 1884 in 1884–1888 (Ca)
CLARK, 1915 (C)
GISLÉN, 1924 (G)
JAEKEL, 1918 (J)
KAMMER & others, 2013 (KSZAD)
MOORE & others, 1978 (M)
MESSING & DEARBORN, 1990 (MD)
MOORE & LAUDON, 1943 (ML)
MOORE, JEFFORDS, & MILLER, 1968 (MJM)
MOORE, 1952 (MLF)
ROUX, MESSING, & AMÉZIANE, 2002 (RMA)
WEBSTER, 1974 (We)
WRIGHT, 1950 (Wr)

An even more elaborate system of symbols is in MOORE and LAUDON (1941).

ALPHABETICAL SYMBOLS

A, B, C, D, E	Carpenter ray system lettering scheme to designate the 5 rays of an echinoderm, with A the anterior (Ca)
A	anterior; anterior ray or radius (ML)
A	areola (MJM)
AB, BC, CD, DE, EA	lettering scheme to designate the 5 interrays of echinoderms, CD the posterior, using the Carpenter ray system (Ca)
adamb	adambulacral plate; plural, adambb
Ai	aerolar index (MJM)
AIB	anterior infrabasal plate (Wr)
AB (also A-B)	interray between A ray and B ray (C)
ACP	ambulacral cover plates (KSZAD)
A_1- A_2	left and right brachials, respectively, of A-ray arm (C)
Amb	ambulacral (Ba, ML, MLF); plural, AmbAmb (ML), Ambb (MLF)
Ant	anterior (MLF)
AntL	antero–left (MLF)
AntR	antero-right (MLF)
ant.R.	anterior radius (Ba)
AR	anterior radial (ML)
Ax or AX	axillary (ML, MLF); plural, AxAx (ML), Axx (MLF), (M)
ax	entire brachitaxis (RMA)
B	basal plate (Ba, ML, MLF); plural, BB (ML, MLF)
B	B ray or radials (Ca)
BC (also B-C)	interray between B ray and C ray (C)
B circlet	basal plate circlet (Wr)
B_1- B_2	left and right brachials, respectively, of B-ray arm (C)
Br	brachial (ML, MLF); free brachial (Ba); plural, BrBr (ML), Brr (MLF)
Brax	axillary brachial (RMA)
Br_1 or Br1	first brachial (C)
Br_2 or Br2	second brachial (C)
Br4	fifth brachial plate of an undivided arm
$\overline{Br}$	fixed brachial (Ba)
BrT	brachitaxis (M)

C	columnal (MLF); plural, CC
C	C ray or radials (Ca)
C	crenularium (MJM)
CD (also C-D)	interray between C ray and D ray, posterior position (C)
C_1- C_2	left and right brachials, respectively, of C-ray arm (C)
CBr	cup brachial (MLF); plural, CBrr
CIBr	cup primibrachial (MLF); plural, CIBrr
CIIBr	cup secundibrachial (MLF); plural, CIIBrr
Cd	centrodorsal plate (G)
Ci	cirral plate (MLF); plural, Cii
D	D ray or radius (Ca)
DE (also D-E)	interray between D ray and E ray (C)
DFR	divergence of articular ridges on opposite columnal articula (MJM)
DS	dististele (We)
D_1- D_2	left and right brachials, respectively, of D-ray arm (C)
E	E ray or radius (Ca); epifacet (MJM)
Ei	epifacetal index (MJM)
EA (also E-A)	interray between E ray and A ray (C)
E_1- E_2	left and right brachials, respectively, of E-ray arm (C)
F	articular facet (M)
Fi	articular facetal index (MJM)
fBr	fixed brachial (ML); plural, fBrBr
Hi	height index (MJM)
IAmb	interambulacral (Ba, MLF); plural, IAmbAmb (Wr)
iAmb	interambulacral (Ba, MLF); plural, iAmbb
iamb	interambulacral (M); plural, iambb
IB	infrabasal (Ba, C, ML, MLF); plural, IBB
IBr	interbrachial (ML); plural, IBrBr
IBr	primibrachial (RMA)
IBr1	first interbrachial plate (RMA)
iBr	interbrachial (Ba, C, MLF, Wr); plural, iBrr, IBrBr
iIAmb	interprimambulacral (Ba)
iIIBr	intersecundibrachial (Ba)
iIIAmb	intersecundambulacral (Ba)
in	internodal (M); plural, inn
IN	internodal (MJM)
IN	internode (MJM)
iN-1	first-order internodal (M)
iN-2	second-order internodal (M)
iN-3	third-order internodal (M)
iN-4	fourth-order internodal (M)
Ini	internodal index (MJM)
iP	intrapinnular (M); plural, iPP
IR	interradius (Ba)
iR	inferradial (ML); interradial (MLF); plural, iRR
iRA	inferradianal (ML)
ISBr	intersecundibrachial (ML, Wr); plural, ISBrBr
ITBr	ITBr intertertibrachial (ML); plural, ITBrBr
K	columnal (MJM)
L	lumen (MJM)
L	lintel (WIA)
LAIB	left anterior infrabasal plate (Wr)
LAB	left anterior basal plate (Wr)
LAR	left anterior radial plate (Wr)
Li	luminal index (MJM)
LPB	left posterior basal plate (Wr)
LX	left proximal plate of the anal sac (Wr)
MS	mesistele (We)
MCT	mutable collagenous tissue (Wilke, 2020)
N	nodal (MJM); plural, NN (M)
Ni	nodal index (MJM)
NT	noditaxis (MJM)
O	oral plate; plural, OO
O1–O5	oral plates (sensu KSZAD)
P	perilumen (MJM)
P	pinnule (MD)
P	primanal (J)
P_a	first inner pinnule (C)
P_b	second proximal pinnule (C)
P_c	third proximal pinnule (C)
P_d	distichal pinnule (C)
P_p	palmar pinnule (C)

P_2	second outer pinnule (C)
P_2-P_b	second pair of proximal pinnules (C)
P_3	third outer pinnule (C)
PAx	axillary primibrachial; plural, PAxAx (Wr)
PB	posterior basal plate (Wr)
PBr	primibrachial plates; plural, PBrBR; numbered PBr_1, PBr_2, PBr_3, etc. from proximal to distal (Wr)
Pi	periluminal index (MJM)
PPCP	primary peristomial cover plates (KSZAD)
PS	proxistele (We)
QBr	quartibrachial, plural (Wr)
R	radial plate (Ba, ML, MLF); plural, RR
RA	radianal plate (Ba, ML, MLF)
RAB	right anterior basal plate (Wr)
RAIM	right anterior infrabasal plate (Wr)
RAR	right anterior radial plate (Wr)
R circlet	radial plate circlet (Wr)
RPB	right posterior basal plate (Wr)
RPIB	right posterior infrabasal plate (Wr)
RX	right sac plate (Wr)
SAx	axillary secundibrachial, plural, SAxAx (Wr)
SBr	secundibrachial plates; plural, SBrBR; numbered SBr_1, SBr_2, Sbr_3, etc. from proximal to distal (Wr)
SCP	shared cover plates (KSZAD)
SR	superradial plate (M); plural, SRR
T	taxis (MJM)
TBr	tertibrachial, plural (Wr)
T-plate	subanal (Br)
X	anal X plate; plural, XX
Z	zygum (MJM)
Zi	zygal index (MJM)

NUMERICAL SYMBOLS

1-2-3-4	proximal to distal sequence of the number of plates in successive ranges of fixed regular interradial plates (number varies per taxon) (AK)
1IN or 1	priminternodal (We)
2IN or 2	secundinternodal (We)
3IN or 3	tertinternodal (We)
4IN or 4	quartinternodal (We)

Note: the following are Roman numerals (I, II, III, IV, V) *and not the capital letters* I *or* V.

IAx	primaxil (Ba); plural IAxx (MLF)
IAmb	primambulacral (Ba)
Ibr	primibrachial (M); plural Ibrr
IBr	free primibrachial (Ba); primibrachial (C), MLF); costal (C)
IBr_1- IBr_2	free first primibrachial, free second primibrachial (Ba); first primibrachial, second primibrachial (MLF)
IBr_3	third primibrachial plate (RMA)
IBr_{3+4}	third and fourth primibrachial for a syzygial pair (MD)
IBr_2	costal axillary (C)
$\overline{IBr}$	fixed primibrachial (Ba)
IIAx	secundaxillary (Ba); pural, IIAxx (MLF)
IIBr	free secundibrachial (Ba)
IIBr	secundibrachial (C) (MLF); plural, IIBrr (MLF)
IIBr	distichal (C)
$IIbr_4$	fourth brachial plate in the primibrachitaxis (RMA)
IIBr4	entire secundibrachitaxis (RMA)
IIBr4	fourth secundibrachial (RMA)
IIIBr5ax	third brachitaxis has 5 brachial plates (RMA)
$\overline{IIBr}$	fixed secundibrachial (Ba)
$IIBr_1$- $IIBr_2$	first secundibrachial, second secundibrachial (Ba, MLF)
IIIBr	tertibrachial (Ba, C)
IIIBr	palmar brachial (C)
$IIIBr_{ax}$	third postradial axillary (C)
IVBr	first post-palmar brachial (C)
IVBr	tertibrachials (C)
VBr	second post-palmar brachial (C)
VIBr	third post-palmar brachial (C)
P-3-4-5	proximal to distal sequence of the number of plates in successive ranges of fixed posterior interradial plates, P is for primanal (number varies per taxon) (AK)
N-3-2-1-2-3	Nodal (N) and internodal pattern in the column (We)

MISCELLANEOUS SYMBOLS

□	ankylosis (G)
Δ	deltoid plate (Ba)
/	armlet or ramule (G)
$\bar{1}$, $\underline{2}$	bar over or under numeral that stands for brachial indicates position of pinnule (G)
+	syzygy (G)
□	synarthy (G)

The list presented here is an attempt to be comprehensive but may not be complete. However, it should be helpful in decoding crinoid literature. These patterns, abbreviations, and symbols can be useful for labeling morphological features in diagrams, accompanied by a key to avoid confusion.

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