

APPENDIX 1

The 127 coded characters used in cladistic analyses of genera assigned to families

Monticuliporidae and Mesotrypidae. These characters were cladistically informative (i.e., were synapomorphic) having states shared by in-group genera. This is a partial listing of 267 characters developed from the following sources (R. L. Anstey, personal communication):

Anstey (1978), Anstey (1990), Anstey and Pachut 1995 (Appendices A and B), Anstey and Perry (1970, 1973), Blake and Snyder (1987), Corneliussen and Perry (1973), Cuffey and Blake (1991), Hageman (1991), Hickey (1988), Key (1990), McKinney (1977, 2000), Pachut and Anstey (1984), Pachut, Anstey, and Horowitz (1994), Prezbindowski and Anstey (1978), Spearing (1998), Tang and Cuffey (1998), and Taylor and Weedon (2000).

Characters that could not be evaluated within a genus were coded using a question mark.

- 1 - Zoarial form: encrusting or erect, uniserial threads=0
 - encrusting, multiserial thin sheets=1
 - elevated as hemispheres or mounds=2
 - elevated as stalks, fronds or branches=3
- 2 - Zoarial form: colonies not multiserial or not elevated above substratum=0
 - multiserial colonies elevated above the substratum, including multilaminar, hemispherical, cylindrical, ramose, hollow ramose, or sheet-like (unilaminar, bilaminar, and radially frondescant) forms=1
 - multiserial, multilaminar, or nonlaminar amorphous elevated colonies ("massive")=2
 - massive zoarium with cyclic repetitions of endozone-exozone transitions in successive laminar growth zones=3
- 3 - Zoarial form: non-multilaminar=0
 - multilaminar, vertical growth through successive regeneration=1
 - multilaminar, vertical growth through successive overgrowths=2
- 5 - Zoarial form: encrusting or slightly elevated (vertical growth exceeding that of a thin sheet)=0
 - hemispherical=1
 - cylindrical or flattened cylindrical stems or sheetlike expansions=2
 - cylindrical, dichotomously or laterally branching stems rounded or flattened (elliptical) in cross section=3

- 6 - Zoarial form: noncylindrical or nonelliptical in cross-section=0
 - cylindrical, with circular or semicircular cross-section=1
 - cylindrical, with oval or elliptical cross-section=2
 - cross-section that of a flattened or polygonal or subpolygonal branch=3

- 7 - Zoarial form: nonmultiserial or nonbranching or non-pillar-like zoarium=0
 - branching or pillar-like, cross-section circular or rounded, or flattened oval cross-section=1
 - branching or pillar-like, cross-section polygonal or subpolygonal=2
 - branching or pillar-like, cross-section hexagonal=3

- 8 - Zoarial form: nonmultiserial or nonbranching zoarium=0
 - dichotomous branching=1
 - lateral branching=2

- 9 - Zoarial form: nonmultiserial or noncylindrical or not having branches or stalks with a circular or
 - subcircular cross-section=0
 - cylindrical, stem diameter greater than 8 mm=1
 - cylindrical, stem diameter between 8 and 4 mm=2
 - cylindrical, stem diameter 4 to 1.5 mm=3
 - cylindrical, stem diameter 1.5 to 0.6 mm=4
 - cylindrical, stem diameter 0.6 mm or smaller=5
 - cylindrical, stem diameter 0.4 mm or smaller=6
 - cylindrical, stem diameter 0.3 mm or smaller=7

- 10 - Zoarial form: nonmultiserial or noncylindrical or not having a circular or subcircular cross-section=0
 - cylindrical, uniform diameter=1
 - cylindrical, moderately variable diameter=2
 - cylindrical, highly variable diameter=3

- 22 - Zoarial form: nonelevated or encrusting, or nonmultiserial=0
 - multiserial encrusting or elevated, nonbilaminar=1
 - flattened cylindrical branches or explanate fronds lacking mesothecae=2
 - explanate nonbranching bilaminar fronds with mesothecae=3
 - flattened or polygonal branches or cylindrical narrow stalks with mesothecae=4
 - flattened branches or stalks with mesothecae and nonzooidal (non-autozooeical) margins=5

- 25 - Zoarial form: zoarial base with open autozooeical apertures (or base not observable)=0
 - zoarial base heavily calcified, lacking apertures=1

- 31 - Basal epitheca: absent or not observable=0
- present, thinly developed=1
 - present, thick and wrinkled=2
- 32 - Basal epitheca: absent or not observable=0
- present, not projecting beyond zooecial limits=1
 - present, projecting beyond outer edges of zooecia=2
- 33 - Locus of budding: linear, or one-dimensional, or nonmultiserial=0
- planar, or two-dimensional=1
 - not confined to a single line or plane, or three-dimensional=2
- 34 - Budding: zoaria nonmultiserial, or nonerect, or lack localized budding centers (i.e., disordered budding) within branches, fronds, or stems=0
- localized along a linear endozonal axis, style, plate or other surface=1
 - originating from an axial zooid (basilozoid)=2
 - originating from a localized zooid cluster=3
- 37 - Budding: zoaria not multiserial=0
- irregular in multiserial zoaria=1
 - semi-regular in multiserial zoaria=2
 - highly geometric in multiserial zoaria=3
- 38 - Budding: zoarium non-hemispherical=0
- zoarium hemispherical, all zooecia perpendicular to basal layer=1
 - zoarium hemispherical, zooecia radially oriented from a single point of origin=2
- 39 - Budding: exozone absent, or exozonal zooecia close-packed, unaligned or irregular=0
- aligned in non-curving rows=1
 - aligned into curving rows or series=2
 - intersecting spiral rows form a Fibonacci or sunflower pattern=3
- 41 - Zooecial boundaries (defined by edge of zooecial wall if neighboring zooecia are not in contact, or by midpoint of wall or dark line in wall if neighboring zooecia are in contact):
- polygonal or rectangular=0
 - subpolygonal or subrectangular=1
 - subcircular or subelliptical=2
 - circular or elliptical=3
- 42 - Zooecial apertures: uniserial zoaria=0
- polygonal (with angular corners) in multiserial zoaria=1
 - subpolygonal (with rounded corners) in multiserial zoaria=2
 - rounded subcircular or subelliptical in multiserial zoaria=3
 - rounded circular or elliptical in multiserial zoaria=4

- 43 - Zooecial apertures: polygonal in endozone (or equivalent) and remaining polygonal in exozone, or no differentiation between endozone and exozone=0
- polygonal in endozone (or equivalent) and becoming subpolygonal in exozone=1
 - polygonal or subpolygonal in endozone (or equivalent) and becoming subcircular (or subelliptical) to circular in exozone=2
- 47 - Zooecial apertures (in exozone): circular, elliptical, subelliptical or otherwise nonpolygonal=0
- irregularly polygonal or subpolygonal=1
 - regularly polygonal or subpolygonal=2
- 58 - Autozooecial apertures: minimum diameter greater than 0.25 mm=0
- minimum diameter between 0.18 and 0.25 mm=1
 - minimum diameter between 0.12 and 0.18 mm=2
 - minimum diameter between 0.07 and 0.12 mm=3
 - minimum diameter less than 0.07 mm=4
- 67 - Autozooecia: contiguous, on all sides in multiserial zoaria, or along a chain of zooids in uniserial zoaria=0
- partially isolated by small polymorphs, vesicles, or stereom in multiserial zoaria=1
 - completely isolated=2
- 68 - Endozone-exozone: no distinction present=0
- somewhat distinct=1
 - markedly distinct, abrupt transition=2
- 69 - Change in wall thickness between endozone and exozone: no transition=0
- very gradual=1
 - moderately gradual (as in most trepostomes)=2
 - abrupt (as in most cryptostomes)=3
- 70 - Zooecial bend: absent=0
- rounded zooecial bend=1
 - abrupt zooecial bend=2
 - abrupt deflection, deflecting both distal and proximal walls=3
 - abrupt deflection, visible in proximal wall only=4
- 71 - Endozone: undifferentiated or absent=0
- present, with gently curving zooecial walls=1
 - present, with straight linear zooecial walls=2
- 72 - Endozone: absent or highly variable in thickness=0
- thin, less than 4 mm in diameter or thickness=1
 - intermediate, between 4 and 10 mm in diameter or thickness=2
 - thick, greater than 10 mm in diameter or thickness=3

- 74 - Length of endozonal portion of zooecium: not distinguishable=0
- short (confined to recumbent portions of zooecia, or shorter than one zooecial diameter)=1
 - intermediate (extending 1-3 zooecial diameters)=2
 - long (extending more than 3 zooecial diameters)=3
- 75 - Autozooecial orientation: no change from major axis of colony growth=0
- reorientation angle low, 10-30 degrees=1
 - reorientation angle moderate, 30-60 degrees=2
 - reorientation angle high, 60-90 degrees=3
- 76 - Budding: limited to encrusting base of colony=0
- present above colony base=1
- 77 - Budding: intercalated budding absent in vicinity of endozone-exozone boundary=0
- intercalated budding prominent in vicinity of endozone-exozone boundary=1
 - intercalated budding prominent above endozone-exozone boundary=2
- 79 - Budding: none in exozone, or exozone absent=0
- non-localized in exozone=1
 - restricted to monticules or annuli in exozone=2
- 81 - Budding: axial endozone absent=0
- axial endozone present, remnant growing tips absent=1
 - axial endozone present, remnant growing tips present=2
- 83 - Budding: endozone absent=0
- endozone present, with new buds having flat walls with pre-existing autozooecia=1
 - endozone present, with new buds having curved walls with pre-existing autozooecia=2
- 84 - Budding: axial endozone absent=0
- new buds irregularly polygonal or rounded, or radially arranged around a linear axis=1
 - triangular buds at corners of hexagonal autozooecia=2
 - quadrate buds at corners of quadrate zooecia=3
- 87 - Axial zooecia: axial endozone absent or no axial zooecia=0
- a few zooecia follow axis for short distances=1
 - axial bundle weakly defined=2
 - axial bundle well defined=3
 - axial bundle large (10+ axial zooecia) and well defined=4
- 88 - Budding: axial endozone absent=0
- endozone present, without spiral budding pattern=1
 - endozone present, with spiral budding pattern=2

- 89 - Budding: axial endozone absent=0
- present, non-radial pattern in endozonal cross-section=1
 - present, radial pattern in endozonal cross-section=2
 - present, strongly radial spoke-like structure=3
- 90 - Budding: axial endozone absent=0
- axial zooecia polygonal or subpolygonal, lacking strongly geometric arrangement=1
 - axial zooecia with strongly geometric budding pattern=2
- 91 - Budding: axial endozone absent=0
- present, medial rows of zooids absent in endozonal cross-section=1
 - present, medial rows of zooids present in endozonal cross-section=2
- 93 - Basal zooecium (at colony base, or along mesotheca, or other budding surface): attenuated, smaller than distal portions of zooecia=0
- same diameter as distal portions of zooecia=1
 - weakly inflated base=2
 - strongly inflated or hemispherical=3
- 94 - Basal zooecium: zoarium nonmultiserial, or no flat base (keel) in recumbent portion=0
- flat base (keel) present in recumbent portion=1
- 95 - Basal zooecium: zoarium nonmultiserial, or no sinuses (indentations) in cross-section of recumbent portion=0
- sinuses (indentations) present in cross-section of recumbent portion=1
- 97 - Basal zooecium: recumbent zones absent=0
- recumbent zones limited to zoarial base=1
 - recumbent zones present above zoarial base=2
- 98 - Basal zooecium: zoarium nonmultiserial, or recumbent zone absent=0
- recumbent zone present, length of zooecial overlap short, less than one zooecial diameter=1
 - recumbent zone present, length of zooecial overlap long, more than one zooecial diameter=2
- 100 - Shape of living chamber: equant, depth approximating width=0
- elongate, depth much greater than width=1
- 103 - Walls thickness variation: uniform or uniformly increasing thickness=0
- unevenly thickened or undulating but not distinctly beaded=1
 - distinctly beaded (moniliform) =2
- 105 - Interzooecial exozonal wall thickness: less than 0.01 mm, or exozone absent=0
- between 0.01 and 0.04 mm=1
 - greater than 0.04 mm=2

- 106 – Interzooecial endozonal wall thickness: endozone absent=0
- less than 0.01 mm=1
 - between 0.01 and 0.03 mm=2
 - greater than 0.03 mm=3
- 107 - Zooecial walls in endozone: regular, or endozone absent=0
- wavy=1
 - crenulated=2
 - corrugated (fluted)=3
- 108 - Zooecial walls in exozone: regular, or exozone absent=0
- wavy=1
 - crenulated=2
- 109 - Mesozooecia: absent=0
- sparse=1
 - abundant=2
- 110 - Mesozooecia: absent=0
- present at autozooecial junctions=1
 - present at junctions and along wall=2
- 111 - Mesozooecia: absent=0
- fewer than two associated with each zooecial aperture=1
 - more than two associated with each zooecial aperture=2
 - completely surrounding each zooecial aperture=3
- 112 - Mesozooecia: absent=0
- present in exozone, small, less than 0.05 mm in diameter=1
 - present in exozone, between 0.05 and 0.10 mm in diameter=2
 - present in exozone, large, greater than 0.10 mm in diameter=3
- 114 - Mesozooecial boundaries (defined by midpoint of wall with neighboring mesozooecia or autozooecia): mesozooecia absent=0
- polygonal=1
 - subpolygonal=2
 - subcircular or subelliptical=3
 - circular or elliptical=4
- 115 - Mesozooecia or cystopores: absent=0
- open at surface=1
 - closed over at surface=2
- 116 - Mesozooecia: absent=0
- present only in exozone=1
 - present, originate near endozone-exozone boundary=2
 - present in outer endozone=3

- 117 - Mesozooecia: absent=0
- present, not clustered=1
 - present in clusters in maculae=2
 - clustered mesozooecia have a vesicular or imbricate cystose structure=3
- 118 - Mesozooecia: absent=0
- present, not clustered=1
 - present in small clusters between adjacent zooecial apertures=2
- 120 - Mesozooecia or exilazooecia: absent=0
- present, most not beaded or moniliform=1
 - present, most beaded or moniliform=2
 - beaded or moniliform small polymorphs or incipient zooecia only in lowermost portion of exozone=3
- 121 - Mesozooecia or cystopores: absent or not tabulate=0
- tabulae or vesicle plates widely spaced, spacing greater than lateral diameter=1
 - tabulae or vesicle plates closely spaced, spacing less than lateral diameter=2
- 122 - Mesozooecial tabulae: mesozooecia absent or not tabulate=0
- slightly curved, distally concave=1
 - planar=2
 - slightly curved, distally convex=3
- 124 - Mesozooecia or cystopores: absent=0
- number between adjacent zooecia nearly constant, or decreases distally=1
 - number between adjacent zooecia increases distally, or characterizes overgrowth layers=2
- 133 - Monticules: absent or rare=0
- irregular in shape=1
 - circular or oval=2
 - radial to stellate=3
- 134 - Monticules: absent or rare=0
- present, zooecial diameter grades imperceptibly into intermonticular region=1
 - present, zooecial diameters change abruptly at edge of monticule=2
- 143 - Monticules or annuli: absent or rare or irregularly shaped=0
- circular or oval=1
 - elongate to bar-like=2
 - forming extensive ridges=3
- 146 - Monticules: absent or lack megazooecia=0
- megazooecia present in monticules=1
 - central macula ringed by megazooecia=2

- 147 – Megazooecia or ampolozooecia: absent=0
- present in exozone=1
 - present in exozone extending from endozone-exozone boundary=2
 - present in exozone and outer endozone=3
- 148 - Megazooecia or ampolozooecia apertural cross-section: absent=0
- polygonal=1
 - subpolygonal=2
 - subcircular or subelliptical=3
 - circular or elliptical=4
- 150 - Monticules: absent or rare=0
- flat or depressed=1
 - elevated=2
 - highly elevated and sharply conical=3
- 152 - Monticules: absent or lack central macula formed by a cluster of small polymorphs=0
- have central macula formed by a cluster of small polymorphs or vesicles=1
 - central macula of small polymorphs or vesicles stellate=2
- 153 - Monticules: absent or lacking central macula=0
- central macula smaller than one zooecial diameter=1
 - central macula larger than one zooecial diameter=2
- 154 - Monticules: absent or rare=0
- present, but irregularly spaced=1
 - present, regularly spaced=2
- 155 - Monticules: absent or rare=0
- small, less than 1.5 mm=1
 - large, greater than 1.5 mm=2
- 156 - Monticules: absent or rare=0
- widely spaced, centers more than 3 mm apart=1
 - closely spaced, centers less than 3 mm apart=2
- 157 - Monticules: acanthostyles (*sensu lato*) absent=0
- acanthostyles present, fewer than one per zooecium=1
 - acanthostyles present, one to three per zooecium=2
 - acanthostyles present, four to seven per zooecium=3
 - acanthostyles present, more than seven per zooecium=4
- 158 - Monticules: acanthostyles (*sensu lato*) absent=0
- present, less than 0.03 mm in diameter=1
 - present, greater than 0.03 mm in diameter=2

- 159 - Coordinated extrazoid feeding currents: unknown, or not reflected in zoarial structure=0
- reflected in zoarial structure=1
- 161 - Wall microgranular: entirely (or laminae indistinct) or recrystallized=0
- microgranular core and laminated outer portions, or bulk of wall microgranular or recrystallized with some distinct laminae=1
 - no microgranular wall material (entirely laminated)=2
- 162 - Wall laminated (in exozone if present): no, or laminations indistinct=0
- yes, laminations longitudinal=1
 - yes, laminations V-shaped, with dark divisional line=2
 - yes, laminations U-shaped (amalgamate), posteriorly flexed laminae greatly dominant over transverse laminae=3
 - yes, laminations transverse across broad regions=4
- 163 - Wall laminated (in exozone if present): no or wall amalgamate=0
- wall weakly integrate, discontinuous or faint dark divisional line=1
 - wall strongly integrate, continuous and prominent dark line, straight=2
 - wall strongly integrate, prominent dark line, crinkled=3
- 164 - Wall strongly laminated (in exozone if present): no, or laminations indistinct=0
- yes, with continuous succession of laminae=1
 - yes, with unconformities or cessation surfaces that extend across several zooecia or mesozooecia=2
 - yes, with zones of wall laminae separated wall units defined distally and proximally by cessation surfaces, the laminae within each unit not extending into any diaphragms=3
- 165 - Diaphragms (or cystiphragms or hemiphragms or hemisepta): absent=0
- granular microstructure=1
 - laminated microstructure, laminae merge inconspicuously into zooecial wall=2
 - laminated microstructure, laminae extend into zooecial wall beneath cessation surfaces dividing the wall into units resembling a stack of nested tumblers=3
- 183 - Acanthostyles (*sensu lato*) : absent or rare=0
- sparse=1
 - abundant=2
- 184 - Acanthostyles (*sensu lato*): absent or rare=0
- unimodal size distribution in zoarium=1
 - simultaneously present as two or more discrete size classes=2
- 185 - Acanthostyles (*sensu lato*): absent=0
- present, maximum diameter (in zoarium) less than 0.03 mm=1
 - present, maximum diameter (in zoarium) greater than 0.03 mm=2

- 186 - Endacanthostyles (long acanthostyles originating in endozone): absent=0
- present=1
- 187 - Exacanthostyles (*sensu lato*): long or short acanthostyles originating in exozone):
absent=0
- present=1
- 188 – Acanthostyles (*sensu lato*): absent=0
- incipient acanthostyles present as small, dark spots at zooecial junction angles=1
- acanthostyles fully developed=2
- 189 – Acanthostyles (*sensu lato*): absent=0
- present, crossed by laminations, clear core absent=1
- present, with clear core flanked by cone-in-cone laminations=2
- present, with clear core flanked by cone-in-cone laminations, width of core (lumen) predominates over laminated margin=3
- 190 – Acanthostyles (*sensu lato*): absent or lacking a clear core=0
- clear core throughout acanthostyle=1
- clear core present toward endozone, completely laminated in outer exozone=2
- 191 – Acanthostyles (*sensu lato*): absent or most noninflecting=0
- most offset but not inflecting apertures=1
- most inflecting apertures=2
- most producing petaloid apertures=3
- 192 – Acanthostyles (*sensu lato*): absent or off-center=0
- centered acanthostyles present along walls=1
- centered acanthostyles common along walls=2
- 193 – Acanthostyles (*sensu lato*): absent=0
- present, but fewer than two acanthostyles around each zooecial apertures=1
- present, with two to four acanthostyles around each zooecial aperture=2
- present, with five to seven acanthostyles around each zooecial aperture=3
- present, forming rings or bands around zooecial apertures=4
- 194 – Acanthostyles (*sensu lato*): absent or absent at zooecial junction angles=0
- present at some of the junction angles between zooecial apertures=1
- present at most or all junction angles between zooecial apertures=2
- present at most or all junction angles between zooecial apertures, and commonly present in the wall between the junction angles as well=3
- 195 – Acanthostyles (*sensu lato*): absent=0
- present, lacking growth discontinuities or rejuvenation=1
- present, with growth discontinuities or rejuvenation=2

- 196 - Complete planar (non-perforated) diaphragms: absent or rare=0
- sparse=1
 - abundant=2
- 197 - Diaphragms, hemiphragms, ring septa, or cystiphragms: absent or rare in endozone or endozone absent=0
- fewer than four in endozone=1
 - more than four in endozone=2
- 198 - Diaphragms, hemiphragms, ring septa, or cystiphragms: absent or rare in innermost 0.5 mm of exozone=0
- fewer than four in innermost 0.5 mm of exozone=1
 - more than four in innermost 0.5 mm of exozone=2
- 199 - Complete planar (non-perforated) diaphragms: absent or rare, or exozone absent or weakly developed or diaphragms absent in exozone=0
- present in exozone=1
 - present in exozone and endozone=2
- 200 - Complete planar (non-perforated) diaphragms: absent or rare in endozone, or endozone absent or weakly developed, or limited to basal diaphragms=0
- present at scattered levels in endozone=1
 - present at a single level in endozone that passes laterally into the exozone=2
- 201 - Diaphragms, ring septa, cystiphragms, and hemiphragms: absent or rare, or present as single structures in exozone=0
- widely spaced in exozone, spacing greater than one zooecial diameter=1
 - closely spaced in exozone, spacing less than one zooecial diameter=2
- 202 - Curved diaphragms: absent or rare=0
- sparse=1
 - abundant, may appear as crescentic bands in zooecia=2
- 203 - Curved diaphragms: absent, rare, or slightly curved, concave outward=0
- slightly curved, convex outward=1
 - strongly curved, semi-cystiphragms=2
 - fully developed cystiphragms=3
- 204 - Curved diaphragms: absent, rare, or slightly curved, convex outward=0
- slightly curved, concave outward=1
 - line of concave diaphragms extending over numerous zooecia=2
- 205 - Orientation of diaphragms, hemiphragms, or ring septa: diaphragms absent or rare=0
- most diaphragms perpendicular to zooecial wall=1
 - most diaphragms oblique to zooecial wall=2

- 206 - Oblique diaphragms: absent or sparse=0
- high edge attached to proximal walls of zooids=1
 - high edge attached to both proximal and distal walls=2
 - high edge attached to distal walls of zooids=3
- 209 - Cystiphragms: absent=0
- sparse=1
 - abundant=2
- 211 - Cystiphragms: absent=0
- present throughout zoarium=1
 - present only in exozone=2
- 212 - Cystiphragms: absent=0
- present in a vertical, non-overlapping series=1
 - present in a vertical, overlapping series=2
- 213 - Cystiphragms: absent=0
- present, with low curvature=1
 - present with normal curvature=2
 - hemispherical, completely recurved to zooecial wall=3
- 214 - Cystiphragms: absent=0
- present, not joined to a half-diaphragm or diaphragm=1
 - present, abutted by horizontal half-diaphragms=2
 - present, V-shaped or U-shaped, and linked by inclined or oblique semidiaphragms=3
- 215 - Cystiphragms and/or hemiphragms: absent=0
- present, without proximal fringe=1
 - present, with proximal-directed fringes=2
- 216 - Cystiphragms: absent or monticules absent or not oriented with respect to monticules=0
- arranged in linear rows parallel to monticules=1
 - arranged in a semiradial or funnel pattern leading into a monticule=2
 - radially arranged around monticules=3
- 217 - Cystiphragms: absent or not radially arranged around monticules=0
- preferentially located on the sides of zooecia nearest a monticular center=1
 - preferentially arranged on the sides of zooecia away from a monticular center=2
- 218 - Cystiphragms: absent or absent in apertures=0
- present, restricted zooecial aperture rounded or elliptical=1
 - present, restricted zooecial aperture V-shaped or U-shaped=2

- 219 - Cystiphragms: absent, or not present in all zooecia=0
- single or multiple large cystiphragms present in each zooecium=1
 - small, numerous, blisterlike cystiphragms present in each zooecium=2
- 220 - Cystiphragms: absent or absent in apertures=0
- single cystiphragms small, restricting less than one third of the apertural area=1
 - single cystiphragms intermediate, restricting from one third to one half of the apertural area=2
 - single cystiphragms large, restricting more than one half of the apertural area=3
- 221 - Cystiphragms: absent or absent in apertures=0
- present as single, non-nested structures within each zooecium (as seen in tangential sections)=1
 - present as multiple, nested structures within each zooecium (as seen in tangential sections)=2
- 237 - Skeletal growth cycles (regularly spaced cessation surfaces): absent=0
- present=1
- 238 - Budding: uniserial zoaria=0
- multiserial, irregular apertural arrangement=1
 - multiserial zoaria, zooids hexagonally packed=2
 - rhombic or rhombic-linear alignment=3
 - longitudinal rows of zooids=4
 - strongly linear alignment, with longitudinal range boundaries=5
- 255 – Budding surface: nonplanar (including linear)=0
- planar or radiating-planar=1
 - transversely curved=2
 - cylindrical=3
- 256 – Budding: no axial endozone, or endozone with interzooecial budding=0
- intrazooecial budding, no keel and sinus pattern=1
 - intrazooecial budding, with keel and sinus pattern in which autozooecial have concave walls towards the branch axis, and convex walls away from it=2
- 260 – Acanthostyles (*sensu lato*): absent in entire zoarium=0
- well developed in autozooidal walls, and possibly extrazooecial regions=1
 - absent or less well developed in autozooidal walls, but more abundantly developed in nonzooidal regions of stereom=2
- 261 – Fossazooecia: absent=0
- present=1

262 – Stenostyles: absent=0

- present=1
- present with distally extending lateral projections=2

263 – Mesotheca: absent=0

- present in interior or center of frond or branch=1
- absent in interior or center of frond or branch, but present in peripheral region extending to zoarial margin=2

264 – Zoarial margins: lack non-zooidal regions of stereom=0

- have non-zooidal regions of stereom=1
- have non-zooidal regions of stereom developed as annular curved re-entrants=2

265 – Stenostyles: absent=0

- present in autozooidal regions=1
- concentrated in or around zooecial peristomes=2

266 – Amplozooecia: absent=0

- present=1

267 – Mesotheca: absent or non-zigzag=0

- present with zigzag development=1