State University of New York at Cortland
Geology Department

GLY 359 Sedimentary Geology

SPLIT ROCK QUARRY VIRTUAL FIELD PROJECT

On this virtual trip you will collect and interpret lithological and sedimentological data from the Split Rock Quarry outcrop which record the Late Silurian through Middle Devonian sedimentary succession in an abandoned quarry a few miles southeast of the city of Syracuse. See the map on the webpage for location information.

To complete this assignment, you will require web access and a personal computer, where you will examine a series of digital images taken and different scales, short video clips, and larger-scale 3D models of the outcrop. You will be provided with a shortened list of images (of the 95 available) to examine and describe. You will use the observations of the images to characterize the different sedimentary rocks types, sedimentary structures, fossils, bedding and larger-scale stratal geometries. Using scaled imagery, you will measure and log the strata to create a stratigraphic log, and interpret the depositional environments and develop a geologic history for the outcrop.

Once on the website, you have access to several sets of digital data: from wide-angle panoramas and 3D models of the outcrop, to intermediate imagery and close-up images of a small segments of the outcrop and rock samples. The primary data are subdivided into the north and south sides of the quarry (the Outcrop Maps) in which you can access smaller portions referred to as Solocators (labeled A-P) through linked hotspots. These intermediate-scaled georeferenced Solocator images themselves provide access to up to 10 separate spatially-located high-resolution close-up images and videos through linked hot spots.

Your assignment will involve completion of three deliverables: (1) a "field" notebook, (2) a drafted stratigraphic log with accompanying legend, and (3) a short written report. These are described in detail below.

The "Field" Notebook

You will create a digital notebook (in MS Word) to record your observations of digital images throughout the exercise. Each entry in your notebook will be clearly identified and serve as the primary source for your facies analysis and interpretation and subsequent stratigraphic column. Written descriptions for each entry will vary depending on the scale of the image (see below)

and what can be discerned from the image. Please keep in mind that your written descriptions should not contain any interpretations, just stick with the observations.

At a minimum, each entry should contain:

1. Information about the image/sample. Here you including image/hotspot number and a brief description of the nature and scale of the sample (e.g., hand specimen, a 20 cm thick set of strata, or an outcrop approximately 10 m tall and 100 m long).

2. A description of rocks type or rocks types, bedding, sedimentary structures, and fossils present in the image/sample. The types of data observed and described will be scale dependent; a description of a 10 m tall outcrop as viewed from afar would be different from that of an enlarged view of a hand sample that is 3 cm.

For medium and large scale images (Solocator images): Begin your description with a rock name or rock names (underlined) – you might not know with precision, but make your best educated guess and include (1) what you can determine about rock compositions, color(s), and textures, (2) a description of bed or beds in terms of thickness and geometry paying special attention to the bedding planes and potential erosive surfaces, (3) any sedimentary structures making note of size, scale and orientation of the structure, and (4) any additional sedimentary structures and/or fossils or trace fossils. Again, take special note of contacts, especially those that might represent erosional surfaces as they will become important in recognizing different facies, delimiting your stratigraphic units and recognition of disconformities.

For close-up images (and videos): Begin your description with the rock name or rock names (underlined). Following the name, write out a description making sure to include the following observations: (1) color – noting any difference in color of weathered, and if available, fresh surfaces, (2) texture, including grain size(s) and grain size distribution (sorting) if observable, (3) composition of the grains/allochems as best as can be determined, (4) any fossils or trace fossils observable – you should be specific and mention what the fossils are by name if determinable, and (5) any other discernable features regarding bedding, lamination and all other sedimentary structures. Again, if observable in the image, make note of any contact or surface that may be observed.

Once you have completed your descriptions of the outcrop images, begin to think about depositional environments and facies. You will be organizing and synthesizing your field observations and making interpretations on the various facies encountered, so please make sure your field notes are complete and thorough.

Determining Sedimentary/Depositional Facies

Now that you have collected a large amount of data, it's time to begin interpreting it and organizing it into discernable sedimentary facies. It would be helpful to organize your

observations into tabular form (using the facies tables we have used before) and note specific depositional processes or environmental indicators associated with the specific observations. Be as specific as you can with respect to depositional environments (e.g., shallow subtidal tidal influenced). Although I will not collect these facies tables, they will be instrumental in helping you determine stratigraphic units (e.g., formations and/or members) and the geologic history.

Determining Stratigraphic Units

Based on your observational data (and facies interpretations), you are asked to subdivide the entire outcrop into a number of different lithostratigraphic units. Consider your units to correspond to standard rock formations or members of formations. Remember, we define a formation as a body of strata that can be recognized as distinguishable from other stratigraphic units at the scale you are mapping/logging. When considering the attributes of a stratigraphic unit, please keep in mind distinguishing characteristics – what property/trait/feature is characteristic of one unit (e.g., rock types or distinctive bedding) might not be the characteristic criteria (e.g., fossil assemblages representing a set of related environments) of another unit. It is also important to remember that there may be considerable variability within a stratigraphic unit – such that characteristics may systematically change through a single unit (e.g., a shallowing upwards succession) or that characteristics may also alternate/fluctuate within a single unit (e.g., repeating alternating bed sets of intertidal/supratidal sediments). Note that while a stratigraphic unit may correspond to one single facies, many stratigraphic units exhibit two or more identifiable facies. Additionally, while stratigraphic units are unique with respect to the position in both space and time (e.g., a unit may occur only once in a single stratigraphic succession and at a single fixed position), its included facies are not so constrained. For example, you may encounter alternating or repeating facies within a single stratigraphic unit. Note also that it is also possible to have similar facies in two or more stratigraphic units.

Stratigraphic Column

One of the deliverables will be a drafted stratigraphic column of the outcrop. Your stratigraphic column will a to-scale drawing which graphically depicts lithology, bedding, sedimentary structures, fossils and important contacts with subunits clearly delimited based on facies. A template for the stratigraphic column will be provided as a separate file.

Measurements for the stratigraphic units will be taken from (and sometimes extrapolated from) the Jacob staffs that are visible in all Solocator images, the Gigapan image and the 3D model. Like measuring stratigraphic thickness on physical outcrops, you may have to piece together different parts of the outcrop by tracing or correlating laterally specific beds or surfaces to get the full picture.

Here are some tips:

1. The bottom of your section will be 0 m and you will measure up the outcrop perpendicular to bedding. You do NOT have to measure the thickness every bed, just facies/stratigraphic units. Expect to measure between 12–16 m of section and plan for that in your log.

2. Graphic logs should faithfully represent was is observed in the field. The lithologic column will use appropriate lithologic patterns (e.g., stipple pattern for sandstones, dashes for mudstones – see attached) and have as its right-hand edge plotted with respect to grainsize. It is okay to modify the standard lithologic patterns to provide more precise representation of the rocks observed (e.g., a standard brick pattern for limestone might include small "W"s inside the brick pattern to indicate carbonate wackestone). While planning to draft the observed bedding in the lithology column, it would be better to draft beds as they occur in the outcrop (e.g., thin or thick) and include some of their geometry (wavy or planar surfaces). Likewise, it is good practice to draft the nature of stratigraphic contacts as they occur (e.g., if the contact is an erosional surface, draft it as such showing the truncated underlying beds). Note also the you are required to indicate fossils and sedimentary structures or other elements with symbols in the appropriate columns in the log (at the stratigraphic levels/height they occur in the section).

3. Identify each facies with a unique identifier (e.g., number). Note, unlike stratigraphic units (see below), your facies may not progress upwards in a unique succession and you may have recurring, repeating or even alternating facies within one stratigraphic unit or across several stratigraphic units.

4. Identify each stratigraphic unit with a unique identifier (e.g., letter). Unlike for facies (see above), your stratigraphic units occupy a unique position in succession of strata and time. It is not permissible to have recurring, repeating or alternating stratigraphic units. In the "Unit Descriptions column of the log, describe the unifying characteristic of the stratigraphic unit (including rock types, color, bedding, sed structures, fossils, etc.). It is important to mention in this description the nature of the unit's lower contact.

5. Draw the contacts between stratigraphic units as they occur in the outcrop. Stratigraphic contacts are to be drawn across the entire log (from the thickness column on the left to the sea-level columns on the right) and are generally horizontal. If you believe a contact to be erosional or unconformable, draw the contact as a wavy line.

Accompanying Legend

You will provide on a separate sheet a well-organized and neatly-drafted legend. The legend will include an explanation of all symbols and patterns that occur in your stratigraphic log including explanation of all lithologic symbols for different rock types, sedimentary structures, bedding, fossils and contacts/surfaces between stratigraphic units.

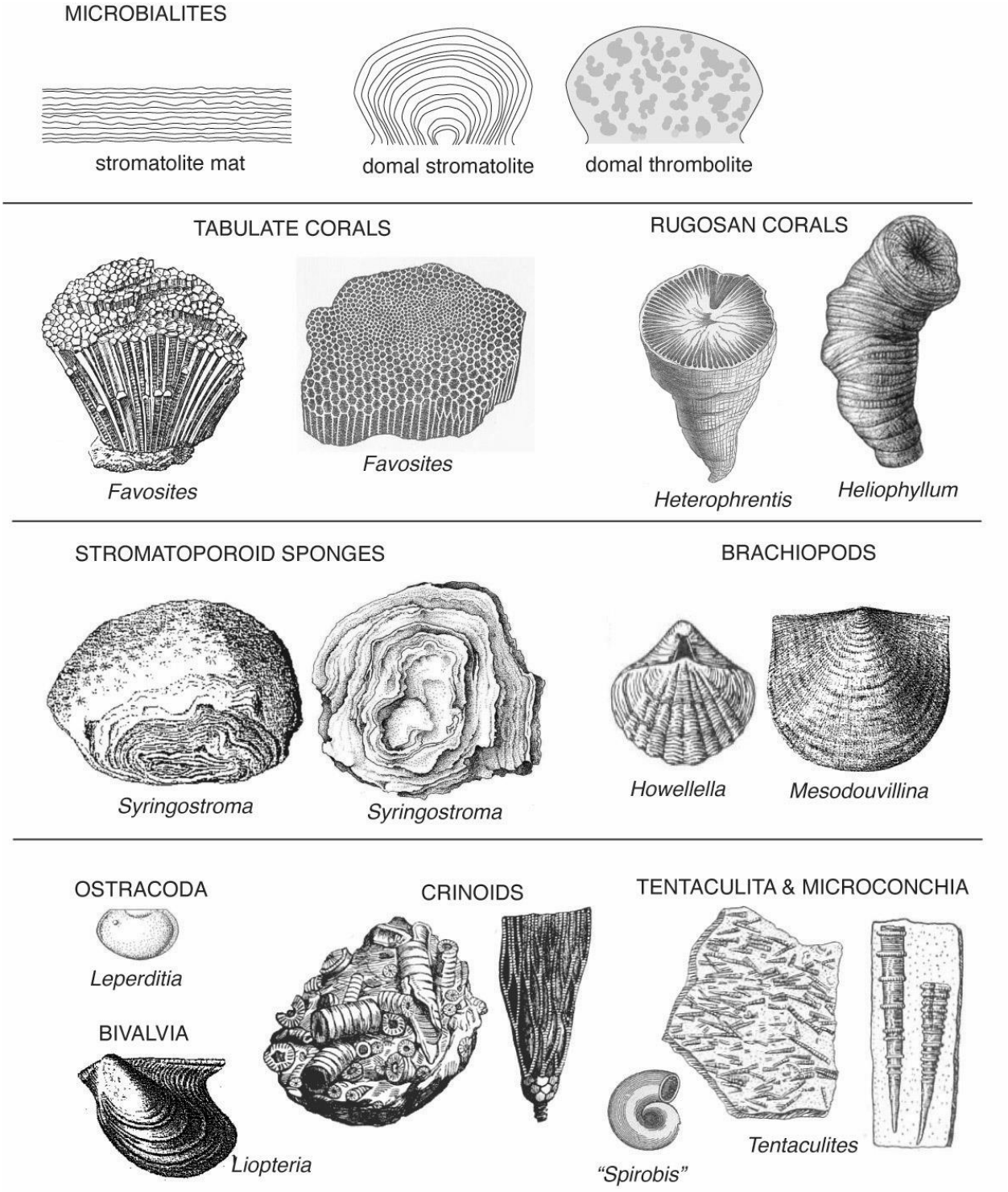
Short Written Report

Your report on the Split Rock Quarry outcrop will centered around the different facies and stratigraphic units. It will include both your observations and your interpretations.

The first half of your report will include descriptions of the different facies you have recognized and the sedimentological criteria used to discern them. For these facies descriptions (plan on paragraph for each facies) you will state what sedimentological attributes (e.g., rocks types, sedimentary structures, fossils, etc.) that characterize the facies ***and*** a brief interpretation of depositional environments for each facies. It is not enough to just list or mention the depositional environment, you need to provide the basis (**evidence**) for your interpretation – e.g., what lithologies, sedimentary structures, fossils, lead you to your calls on depositional environments. Note that your facies descriptions should be organized with respect to depositional environments and may not reflect a succession of stratigraphic units or geologic history.

The second half of the report will be a brief geologic history of the section. In this part, you will discuss the progression of facies and stratigraphic units from oldest (bottom of the section) to youngest (top of section). Please arrange this section with respect to stratigraphic units. It is essential in this section that you also discuss (and provide evidence of) any significant hiatuses or unconformities.

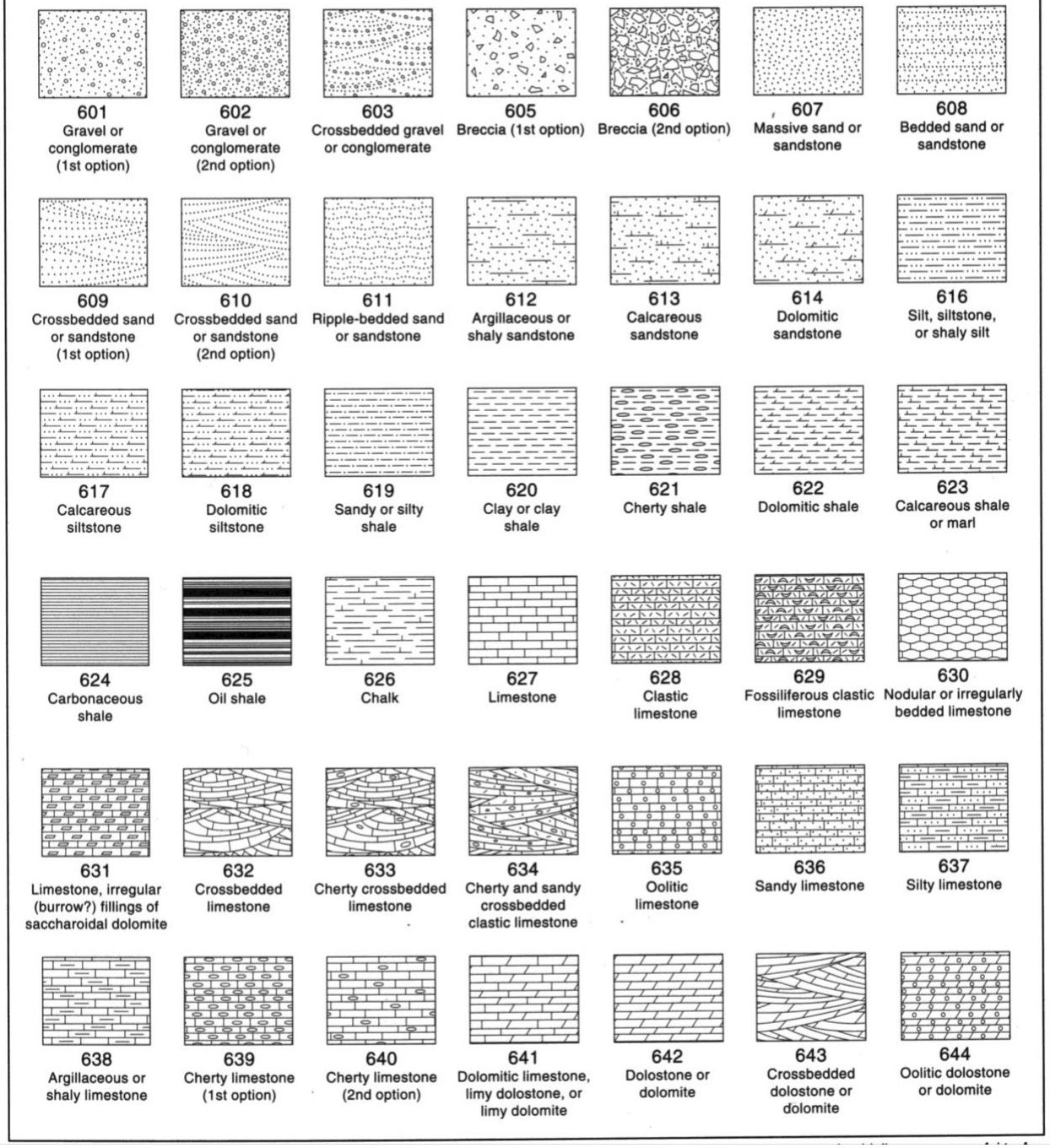
Common Upper Silurian-Middle Devonian Fossils from the Split Rock Quarry



Common lithologic rock patterns used for sedimentary rocks

[Lithologic patterns are usually reserved for use on stratigraphic columns, sections, or charts]

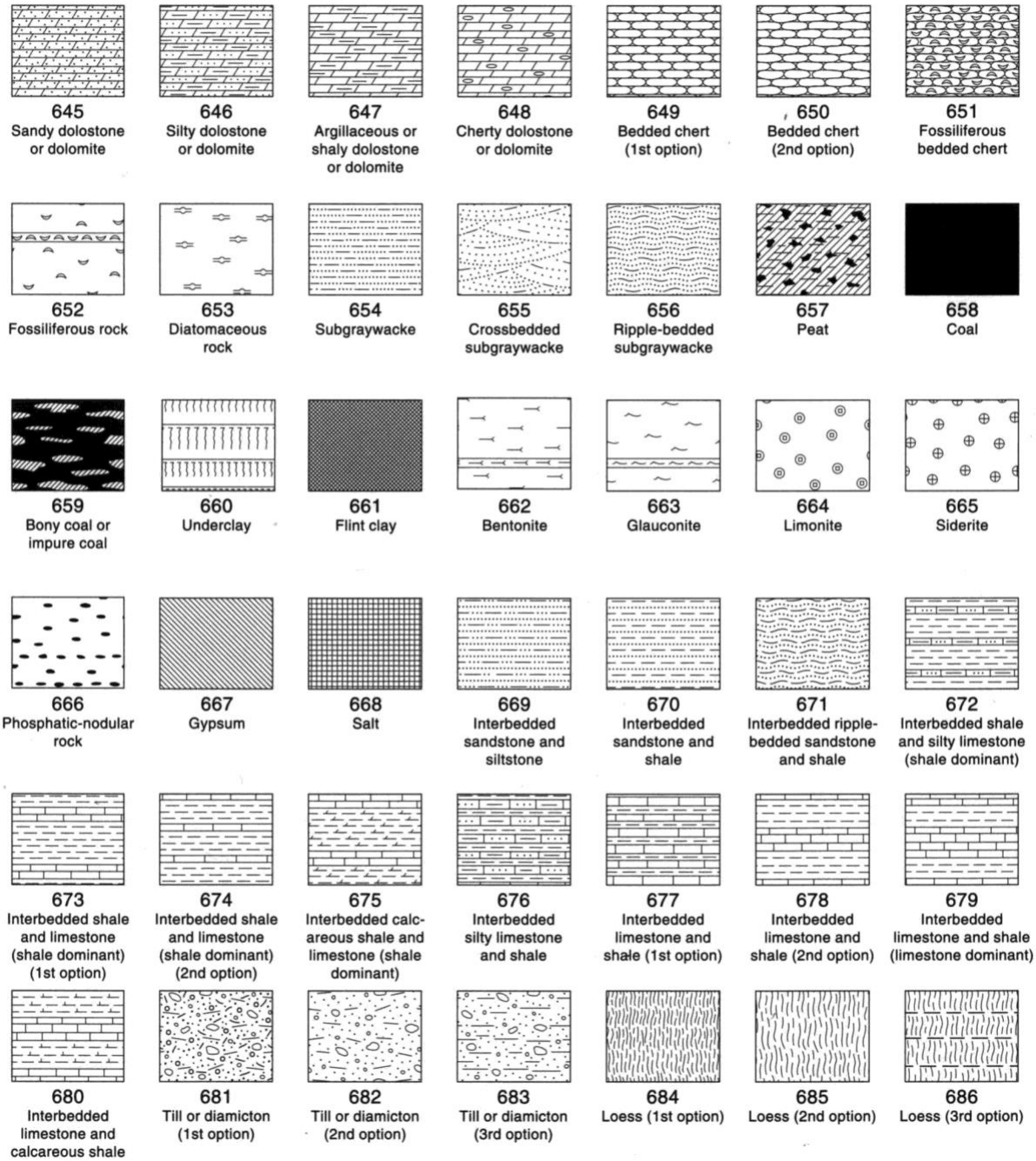
37.1—Sedimentary-rock lithologic patterns



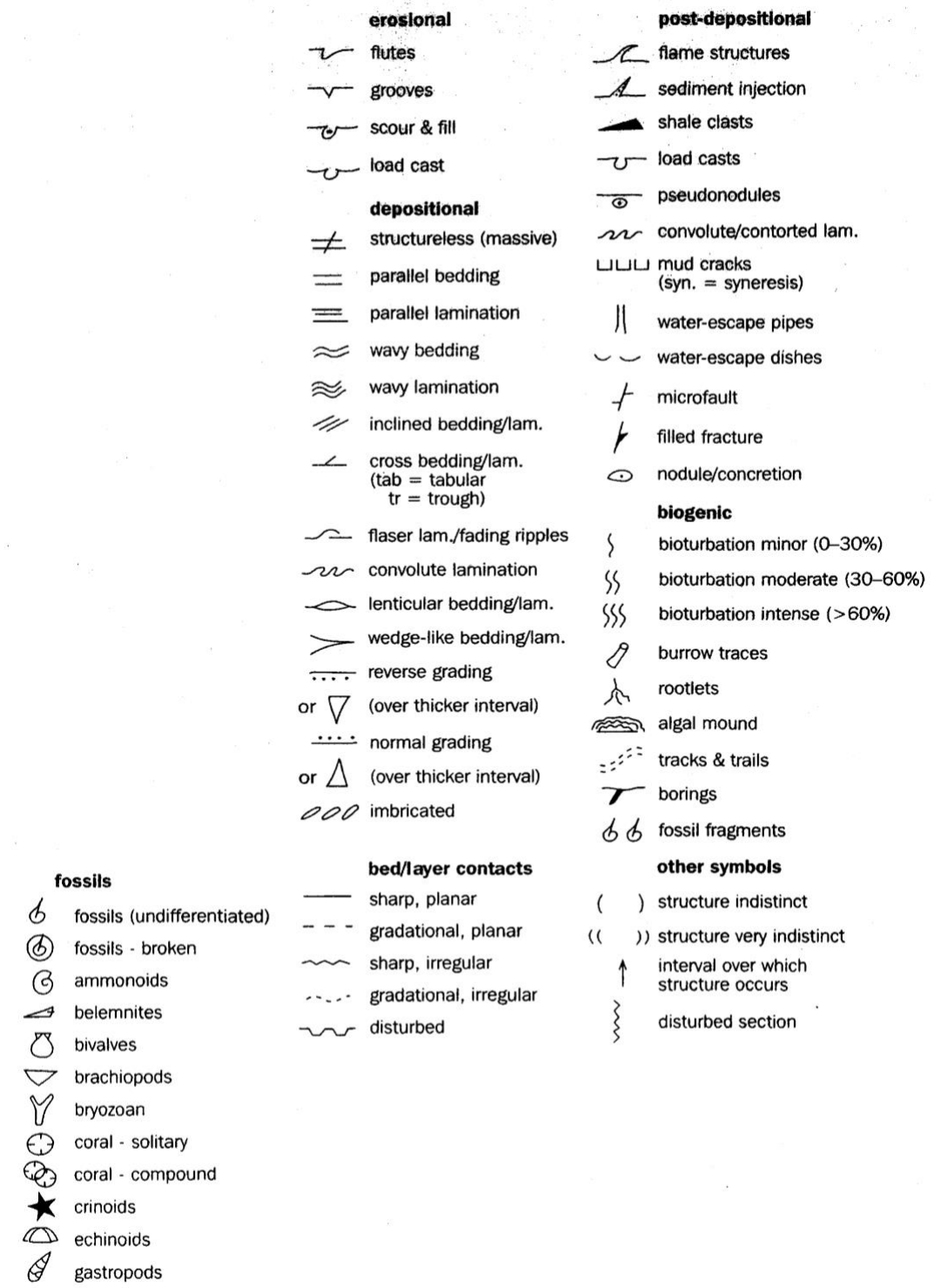
Common lithologic rock patterns (continued)

[Lithologic patterns are usually reserved for use on stratigraphic columns, sections, or charts]

37.1—Sedimentary-rock lithologic patterns (continued)



Common symbols used for sedimentary structures, bedding, fossils, and bed/unit contacts



HEIGHT (m)	UNIT	THICKNESS (m)	LITHOLOGY: CARBONATES (mud, wack, pack, grain, float, rud, frame, bound); MUD (clay, silt), SAND (vf, f, m, c, vc), GRAVEL (gra, peb, cob, bou)	SED STRUCT.	FOSSILS	STRATIGRAHIC UNIT DESCRIPTION	FACIES	SEA LEVEL: subitdal (deep, shallow), intertidal, supratidal