

**BIOEROSION IN LATE ORDOVICIAN AND EARLY SILURIAN TROPICAL
CARBONATE SETTINGS OF ANTICOSTI ISLAND, QUÉBEC, CANADA**

by
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Abstract

Bioerosion was a common process affecting corals and stromatoporoids in reef and off-reef facies on the carbonate ramp which spanned the Ordovician-Silurian boundary on Anticosti Island. *Trypanites* was the dominant macroboring, penetrating more than 40% of 2,500 massive tabulate corals and stromatoporoids examined, occasionally in dense concentrations. Microborings and rare occurrences of probable bivalve borings added to Anticosti bioerosion. Two new embedment structures are described from Anticosti corals and stromatoporoids, *Chaetosalpinx rex* n. ichnospecies and *Klemmatoica linguliforma* n. ichnogenus & ichnospecies. The frequency of macroboring was influenced by facies-level changes in grain size, carbonate content, water depth, storm reworking of sediments and the nature of the skeletal mass bored. These factors regulated exposure time of the host coral or stromatoporoid surface to the watermass and thus influenced bioerosion. Bored samples were most common in muddy off-reef facies, moderate in sandy off-reef facies, and less common in reefs. In off-reef facies, storm-enhanced deposition and reworking of sediments were most important in the burial of eligible host substrates. In reefs, the high competition for space, by skeletal and non-skeletal encrusting epizoans, was likely more limiting for macroborers, which preferred to excavate dead skeletal substrates. Enhanced siliciclastic sediment supply, which produced sand-wave complexes in the Late Ordovician, appears to have locally reduced macroboring frequency in reef and off-reef facies proximal to sediment source. The negative effect of increased burial rate on bioerosion exceeded the positive effect of possible enhanced terrigenous nutrient supply proximal to the source. Skeletal density was the most important property of the host substrate in controlling boring frequency. Macroborers favoured a dense host skeleton likely for its enhanced mechanical strength and adaptability for unlined borings, despite requiring greater energy for excavation. High relief host skeletons were bored more frequently than tabular forms, since their greater capacity to shed sediment would have resulted in prolonged exposure above the seafloor. Temporal changes in boring frequency appears to reflect local shifts in facies and relative sealevel. Mass extinction events near the O/S boundary which eliminated some host corals and stromatoporoids apparently had no effect on boring frequency.

INTRODUCTION

Objectives of the study

This is the first study to focus on bioerosion from the Ordovician-Silurian sequence of Anticosti Island, Québec. The main objectives are to describe the nature of the borings and to quantify the frequency and intensity of bioerosion within the sequence. By using both qualitative and quantitative approaches, this study will attempt to answer the following questions about ancient bioerosion: 1) What organisms were the most significant bioeroders?, 2) Was bioerosion affected by the Late Ordovician mass extinctions?, 3) What factors most significantly controlled bioerosion?, and 4) How does Paleozoic bioerosion compare to modern settings in tropical carbonate environments?

Geological setting

The nearly continuous sequence found on Anticosti Island was deposited as part of a carbonate ramp formed along the eastern continental margin of Laurentia during the Late Ordovician and Early Silurian (Text-figure 1). The sequence of limestones and minor calcareous shales, was deposited in a subtropical to tropical setting, roughly 15° south of the paleoequator (Brunton and Copper, 1994). Seasonal tropical storms are thought to have modified and reworked nearly all of the sediments below fair-weather wave base (Long, 1997). Siliciclastic sediments, e.g. fine quartz sand and silt, associated with sand-wave complexes are concentrated in late Rawtheyan and Hirnantian (Ordovician) strata in the northeastern region of the island and are thought to have been derived from the Precambrian highlands to the north, especially during sealevel drawdowns associated with Late Ordovician glaciation in Africa (Long and Copper, 1987b). Such siliciclastic input, however, is minor in most of the higher Anticosti sequence (Long, 1997). Tectonic deformation of the sequence is slight, with few minor folds and local faults with a displacement of a few meters or less. Located within the lobate (ca. 150,000 sq. km) Anticosti Basin (Copper, 2001), the exposed strata on Anticosti Island are subdivided into seven formations (for references and summary, see Long and Copper, 1994). Lacking evidence for emergent and intertidal features, the sequence is thought to represent a mid- to distal shelf

environment near the western margin of the Iapetus Ocean, 50-100 km south of the Laurentian coast (Copper and Long, 1989). Well preserved fossils are common throughout the sequence and reflect an open marine, epibenthic fauna dominated by calcimicrobes, calcareous algae, corals, stromatoporoids, brachiopods, and echinoderms. Small to large patch reefs occur three times in the Late Ordovician (Mill Bay, Prinsta, and Laframboise members) and twice in the Early Silurian (East Point Member and Chicotte Formation). Tabulate and rugose corals, stromatoporoids and calcareous algae were the dominant reef constructors, but these were also abundant in sandy and muddy off-reef facies. The Hirnantian glaciation of Gondwana (Brenchley et al., 1994) resulted in a eustatic sealevel drop and locally shallowed the Anticosti Island ramp by at least 30-40 m (Text-figure 2)(Long, 1993). The ensuing mass extinction strongly affected tropical marine biota, including reef communities (Brenchley, 1989; Robertson et al., 1991) and eliminated a significant number of stromatoporoid sponge, coral, and brachiopod species (Text-figure 3) (Kaljo and Klaamann, 1973; Copper, 1994, 1995, 1999, 2001; Jin and Copper 1997, 1998).

The nature of bioerosion

Bioerosion is the biological removal of firm to hard substrates, including rock, skeletons (carbonate, siliceous, phosphatic), and wood (Bromley, 1992). Bioerosion is thus distinguished from burrowing, e.g. the displacement of soft, unconsolidated sediment. Although present in terrestrial, fresh- and brackish water settings, bioerosion is most pervasive in marine carbonates (Bromley, 1996). As such, bioerosion is especially significant in shallow marine waters at subtropical to tropical latitudes. An integral part of the carbonate cycle, bioerosion is an important contributor to the destruction of rocky coastlines, firmgrounds, hardgrounds, dolostones and limestones. Bioerosion produces significant so-called 'wave-cut' notches marking the margins of the intertidal zone of modern carbonate environments (Neumann, 1966), thus enabling the definition of ancient high tide levels (e.g. Wilson et al., 1998).

Many marine and terrestrial phyla are capable of bioerosion, often using a combination of both chemical dissolution and mechanical abrasion to excavate, at both the microscopic and

megascopic scales. Chemical bioeroders often use chelating reagents to dissolve carbonate substrates, while mechanical bioeroders penetrate carbonate and non-carbonate materials using a variety of specialized structures, e.g. hooks, spines, teeth, rasping surfaces, etc. (Rice, 1969; Bromley, 1996). Bioerosion is known to have been carried out by bacteria, archaeans, fungi, lichens, green and red algae, and a range of invertebrates (sponges, bryozoans, brachiopods, bivalves, gastropods, cephalopods, echinoderms, crustaceans, and numerous 'worm groups'), as well as vertebrates (e.g. fish) (Bromley, 1970, 1992; Warne, 1975). Bioerosion may be related to behavioural patterns, such as creating shelters (domichnia) within the protective confines of a hard substrate, or to remove edible materials from hard surfaces, e.g. grazers, sea urchins and scarid fish (Bromley, 1970). The latter provide exceptional examples of bioerosion, feeding on limestone to digest the algae contained within. The structural integrity and preservability of reefs, as well as firm-, hard- and rockygrounds, are decreased by bioerosion. In generating cavities, bioerosion alters the nature of sedimentation processes, water chemistry, ecology, and taphonomy of carbonate substrates. Bioerosion commonly accelerates diagenetic processes in carbonates by providing conduits for the passages of fluids, and breaking down calcium carbonate (Ekdale et al., 1984; Pemberton et al., 1988, Jones and Pemberton, 1988). As carbonates are mechanically and chemically abraded, coarse grained substrates (conglomerates, sands, silts) are reduced to finer grained sediments, such as carbonate muds. Such bioerosion of sediment grains may be also performed by particles passing through the guts of sediment swallowers, e.g. echinoids, holothurians or fish (Ekdale et al., 1984). In the production of sediment, carbonate bodies such as reefs increase in volume and area, assisting in the production of sediment aprons (off-reef and intra-reef sediment), allowing reefs to prograde laterally (Copper, 1974). The chemical dissolution of limestone alters local pH and recycles CO_3^{2-} , releasing surplus CO_2 into the atmosphere, contributing to the greenhouse effect. The creation of cavities increases the porosity and permeability of the substrate, and enlarges the amount of three dimensional space within the substrate, providing expanded niches for other biota (e.g. cryptic space) (Kobluk, 1988a). This provides a secluded niche for cryptic intra-sediment faunas in a microenvironment with restricted circulation of oxygenated water. By creating new sediment,

bioerosion may assist bioturbation, i.e. the disturbance of soft sediment. Additionally, the production of metabolites (e.g. mucus) by the borer may stimulate the growth of bacterial films, altering the diagenesis of the substrate, and encouraging further invasion of other bioeroders or grazers.

A common process in modern marine environments, bioerosion has an ancient record dating back to the early Proterozoic, ca. 2.5 billion years ago. Despite a long geologic history, most bioerosion research has focused on modern carbonates. Recent concern for reef health has led to many studies that assess and monitor the effect of anthropogenic influences (e.g. eutrophication) on bioerosion. With as yet little research devoted to Paleozoic bioerosion, the understanding of this important carbonate process, especially during its early phase of evolution, is limited. In this thesis, the nature of marine carbonate bioerosion in the Early to Middle Paleozoic (Ashgill-Llandovery) is emphasized, particularly that of corals and stromatoporoid skeletons from Anticosti Island, Québec, Canada.

Brief history of bioerosion through the Phanerozoic

The earliest known microborings (diameter < 100 μm) were made by endolithic cyanobacteria that penetrated Early Proterozoic stromatolites (*Stratifera*) from northern China (Zhang & Golubic, 1987). By the Early Cambrian, fungi and algae had evolved a boring habit, and along with bacteria continued through the Phanerozoic as the dominant microboring organisms (for a review see Vogel, 1993; Kobluk and Kahle, 1978). The first macroborings (diameter > 100 μm), found in Early Cambrian archaeocyathid reefs from Labrador, are sponge borings (Kobluk, 1981a) and *Trypanites*, a simple cylindrical boring (diameter ca. 2 mm, length ca. 20 mm) made by sipunculid or polychaete worms (James et al, 1977). Taking advantage of hardground surfaces and skeletal substrates, the diversity of macroborings increased in the Early Ordovician (summaries by Kobluk et al., 1978; Palmer, 1982; Vogel, 1993; Bromley, 1994; Edinger, 2000). Noteworthy additions among bioeroders included bivalves and bryozoans in the Ordovician, and barnacles in the Silurian. Large excavations of interconnected chambers, typical of boring sponges, appear in the Late Silurian and Devonian (e.g. *Clionolithes* and *Topsentopsis*: Clarke, 1921; Fenton and

Fenton, 1932). By the Middle Paleozoic, representatives of most modern bioeroding phyla had evolved, with the exception of some substrate grazers. As part of the Mesozoic marine revolution, driven in part by increased predation (Vermeij, 1977; Wood, 1997), boring bivalves diversified in the Late Jurassic to include pholads, gastrochaenids, and anomalodesmatans (Morton, 1990). The most significant radiation of the Mesozoic was among clionid sponges which resulted in myriad *Entobia* boring morphotypes, and have become the dominant modern macroborers (*Cliona*). Sea urchins evolved an effective rasping structure ('Aristotle's lantern') by the Triassic, but did not become significant substrate removers until the Jurassic (Vogel, 1993). Finally, the specialized jaw and skull morphology evolved in Miocene scarid fish has produced the most efficient modern reef excavator (Bellwood and Choat, 1990).

Paleoecology of the host substrate and quantification of bioeroders

Tabulate corals and stromatoporoid sponges lived in subtropical to tropical, shallow marine settings, as indicated by their paleogeographic distribution in the equatorial belts, and their association with large carbonate platforms and reefs. By analogy to modern reef-building scleractinian corals, the growth, abundance and geographic distribution of tabulate corals and stromatoporoids may have been similarly controlled by factors including water temperature and salinity, carbonate saturation, light, turbidity, sediment and nutrient supply, and hard substrate availability (James and Bourque, 1992). It has also been suggested that, as in hermatypic scleractinians, some tabulate corals may have had symbiotic phototropic zooxanthellae (Coates and Jackson, 1987). The main symbionts of modern corals, the dinoflagellate algae, are known as early as the Neoproterozoic (Butterfield and Rainbird, 1998). Local biological interactions at the substrate level, such as competition for space and resources, parasitic infestation, and arrival of new predators or pests are other important factors. Although increased nutrients may encourage coral growth, a resulting increase in competition for light and space by encrusting algae and infesting bioeroders (Hallock and Schlager, 1986) may overwhelm the benefits to the coral (i.e. the 'Janus effect' of Edinger and Risk, 1994).

The factors which promote or inhibit the presence and intensity of bioerosion greatly depend on the composition of the bioeroding community itself. In general, most bioeroders are heterotrophic, with the exception of algae (e.g. chlorophytes) and mixotrophic sponges. Although some borers are selective in substrate preference, the majority will bore any hard substrate available.

The first to attempt quantifying bioerosion (and in doing so naming the process) was Neumann (1966), who measured both rate of bioerosion and sediment production using field experimentation. Since then, numerous authors have directly measured modern bioerosion rates of specific organisms (summaries for microborers: Vogel et al., 2000; for macroborers and grazers: Hutchings, 1986). Subtracting these rates from calcification rates of reef-building corals (net construction minus net destruction) results in a carbonate budget which can predict the viability of the carbonate system with time. Quantification of bioerosion in the fossil record is limited mostly to Tertiary examples (e.g. Pleydell and Jones, 1988; Edinger and Risk, 1994; Perry, 1996) that measured bioerosion abundance, not rate. Studies of Paleozoic bioerosion are generally more descriptive and quantification is limited to presence/absence data. Notable exceptions include examples from the Silurian (Segars and Liddell, 1988; Lebold, 2000) and Devonian (Pemberton et al., 1988).

Advantages and limitations of describing and quantifying Paleozoic bioerosion

Since borings are made in hard substrates, they are generally well preserved as fossils. This means that the discovery of organisms with poor potential for preservation (e.g. soft-bodied) is possible by means of observing the patterns left behind by their behaviour. The shape, size, and structure of a boring can reveal information about the shape, feeding habit, and paleoecology of the borer. In addition, the preservation potential of the borer is enhanced within its boring from disturbance by limiting scavengers and mechanical erosion or chemical dissolution. As well, rapid burial of the host substrate can entomb a borer alive. Unfortunately, a limitation of all trace fossil interpretations is that more than one organism can theoretically produce a similar structure. This imparts uncertainty to any conclusion drawn as to the identity of a borer. Further, fossil borings are usually filled with sediment, restricting 3D cast reproduction, and limiting insight into the

complete structure. High variance in the distribution of borings, in part related to the dynamics of borer larvae settlement, also limits the quantification of bioerosion.

Modern bioerosion research attempts to quantify boring rates and their relation to carbonate budgets. In the fossil record, a carbonate bioerosion rate cannot be precisely measured for a specific unit of time, and accurate rates cannot be determined. Only approximate figures averaged over estimated rates of sedimentation and growth are possible. However, the sequence of boring can be determined by studying contacts (e.g. truncation surfaces) between adjacent and superimposed borings. These relationships can be used to model the order in which the substrates were bored (e.g. early vs. late borers), suggesting relative time. Perhaps more importantly, the extent to which a substrate has been bored (i.e. boring intensity per unit area) can be measured in the fossil record. Since macrobioerosion requires that a substrate be in the taphonomically active zone (TAZ of Davies et al., 1989), burial of a substrate halts macrobioerosion (Bromley and Asgaard, 1993). High boring intensity, while not a direct measure of time, may thereby indicate extended periods of substrate exposure resulting from hiatuses in deposition or removal of sediment. Since borings are *in situ* structures that are unlikely to be transported away from where they were excavated, it is possible to relate boring frequency and intensity with syndepositional conditions, in order to understand factors controlling bioerosion.

MATERIALS & METHODS

Materials

All samples used in this study were collected during field work on Anticosti Island by P. Copper and his associates. This work began in 1966, and now includes a database and collections from more than 2,000 localities, spanning more than 800 m of strata. All members, from the oldest exposed part of the Vauréal Formation (middle Ashgill) at the base on the north coast, to the upper Chicotte Formation at the top (Telychian, Silurian) along the south coast have been sampled. The island is approximately 15,000 sq. km in area, with outcrops along shorelines, rivers, and unsurfaced roads. Field notes corresponding to the coded samples give an

abbreviated locality description, and a NTS metric grid code for the sample location. Collected material used in this study is currently stored at Laurentian University.

Due to their great abundance in the collection, stromatoporoid sponges and tabulate corals were mainly selected for analysis. These included specimens ranging in size from 2 to 50 cm in width and up to 30 cm in height. The sample base included 2,528 well preserved samples from all seven formations, though with deeper water facies and scarcity of corals and stromatoporoids in the lower half of the Vauréal Formation, samples were more abundant higher in the section. Tabulate coral families included mostly sarcinulids, heliolitids, theciids, favositids, multisoleniids, and alveolitids. Stromatoporoid families included mostly clathrodictyids, ecclimadictyids, and aulacerids. The most abundant families, genera, and species are briefly described in Appendix A.

Methodology

All specimens were measured and described in detail as hand samples (complete and/or cut into slabs) under a binocular microscope and as thin sections under a petrographic microscope. Corals and stromatoporoids were identified to the species level where possible, but more often referred only to the genus or family. One of three facies (reef, sandy and muddy off-reef: defined in **Facies** section) was designated for each sample based on field locality notes (Abbreviated list of localities, Anticosti Island—unpublished, P. Copper, Laurentian University, 2001) and direct observation of sediment attached to the samples. To examine lateral variations in bioerosion along the carbonate ramp, Late Ordovician localities on and west of map sheet NTS 12E/11 were designated 'West'; localities on and east of map NTS 12E/10 were designated 'East'. The maximum macroboring intensity (MMI) was measured in 2,528 massive stromatoporoids and tabulate corals by counting the number of macroborings (diameter > 0.5 mm) centered within a 4 sq. cm grid. An index of MMI (Table 1) was recorded for each sample along with the general location of the borings (e.g. upper- or underside of the sample). Some intensely macrobored stromatoporoids were selected to characterize the complete distribution of borings within a coenosteum. Detailed tracings of the bored stromatoporoids were digitized on a flat-bed scanner and converted to a 3-tone (i.e. black, white, grey) digital image, allowing the percentage area of

bored substrate to be calculated. Borings were described from sample surfaces, slabbed sections, and thin sections. Digital calipers accurate to 0.01 mm were used to measure aperture width and length, and boring depth. Select host substrates were measured in triplicate using the point-count method (500 points at 0.3 mm intervals) to approximate skeletal density. Boring frequency was used to analyze and compare internal and external variables. This was calculated by the following formula:

$$\frac{\text{\# of samples of variable X with MMI} > 0}{\text{total \# of samples of variable X}} \times 100 = \% \text{ frequency bored}$$

Data compiled for each sample are listed in Appendix B.

	MMI index					
	0	1	2	3	4	5
Borings per 4 sq. cm	0	1-4	5-9	10-14	15-19	20+

Table 1: Maximum macroboring intensity (MMI) values determined from number of macroborings centered in a 4 sq. cm grid.

SYSTEMATIC PALEONTOLOGY

Numerous terms have been proposed to describe trace fossils in skeletal substrates. Two types of hard substrate trace fossils, borings and embedment structures, are described from Anticosti corals and stromatoporoids. Borings are cavities excavated from a live or dead host skeletal substrate by a boring organism, while embedment structures are cavities produced by the deflection of a live host skeletal substrate around an endosymbiont. Unlike borings, embedment structures are formed without the excavation of host coral or stromatoporoid skeleton, and are not considered a product of bioerosion. While a boring is predominantly formed by excavation, some substrate deflection may occur if formed in a living host coral or stromatoporoid. To describe the longitudinal position within cavity structures, 'proximal' means 'towards the aperture' and 'distal' means 'towards the base'. The origin of most embedment structures forms the distal base of the cavity, and with growth of the host coral or stromatoporoid, the cavity extends proximally to the surface aperture. Conversely, most borings originate from the proximal aperture at the coral or stromatoporoid surface, and extend distally to the base of the cavity. Other terms used in the

following descriptions are based on those used by Bromley (1970, 1994), Ekdale et al. (1984), Palmer and Wilson (1988), and Scoffin and Bradshaw (2000).

Macroborings

Ichnogenus *Trypanites* Mägdefrau

Plate 1, figures 1-5; Plate 2, figures 1-4

Trypanites Mägdefrau, 1932— Type specimen occurs in hardgrounds from the Middle Triassic German Muschelkalk. Described from carbonate marine deposits including firm- to hardgrounds, pebbles, and skeletal substrates. Early Cambrian to Recent.

Diagnosis:

Simple, unbranched, cylindrical borings with a single, circular aperture roughly 1-2 mm in diameter and 1-5 cm in length. Length of boring straight to slightly curved, roughly isodiametric, and normally several times longer than wide. Base of boring blind, with a tapered to rounded terminus. Boring is unlined.

Description of Anticosti samples:

Borings are variable in diameter and in length (Table 2). All *Trypanites* were unlined. Borings were concentrated on the upper dead surface of the host, especially in the centre (Text-figure 4). Borings deep inside the host were mostly concentrated along horizons likely associated with disrupted growth or death surfaces (Plate 1, figure 4). Some time after being bored, these surfaces were overgrown either by the recovery of the host substrate or the encrustation of a new organism. Surface boring intensity increased towards the highest point on the host substrate, and most borings occurred within 1 cm of the surface. Borings into the undersides of samples were relatively uncommon, except in hosts with a sub-spheroidal growth form. Maximum boring intensity was as high as 35 borings per 4 sq. cm.

Paleoecology and taphonomy:

Most borings were drilled into dead (post-mortem) surfaces of host coral or stromatoporoid skeletons. This is evident by the concentration of *Trypanites* on specific host skeletal surfaces, especially the last, upper growth surface, and the lack of host skeletal deflection around the

Simplified images denote



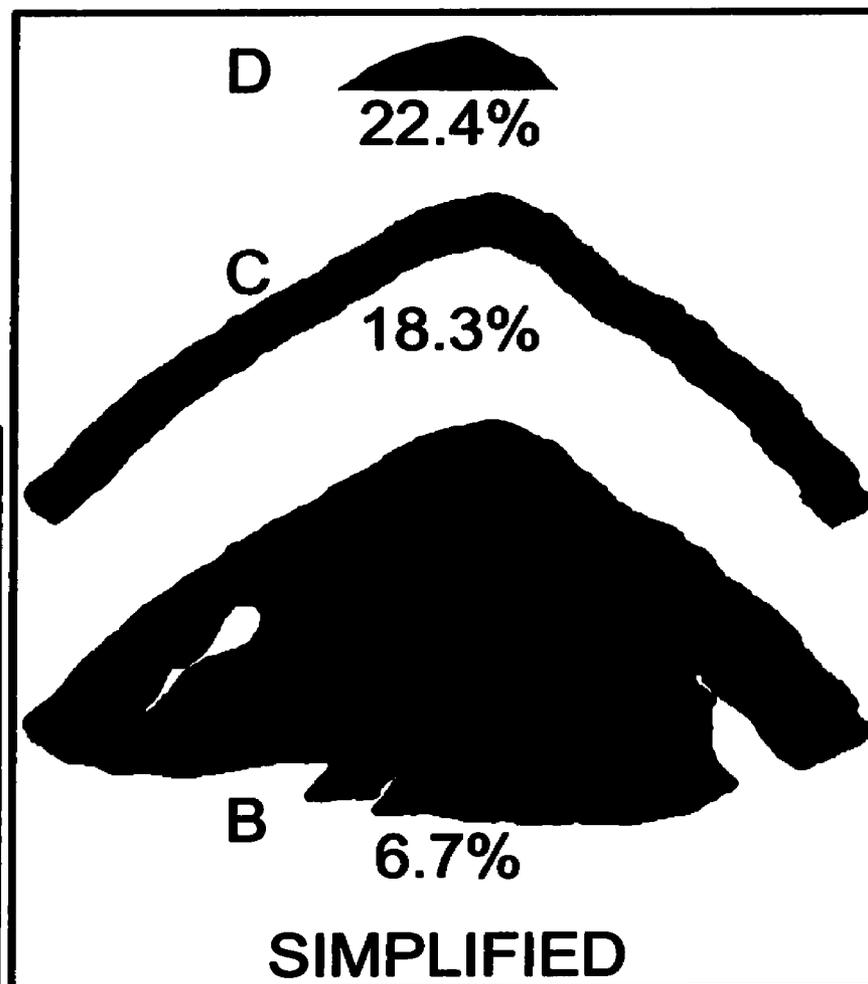
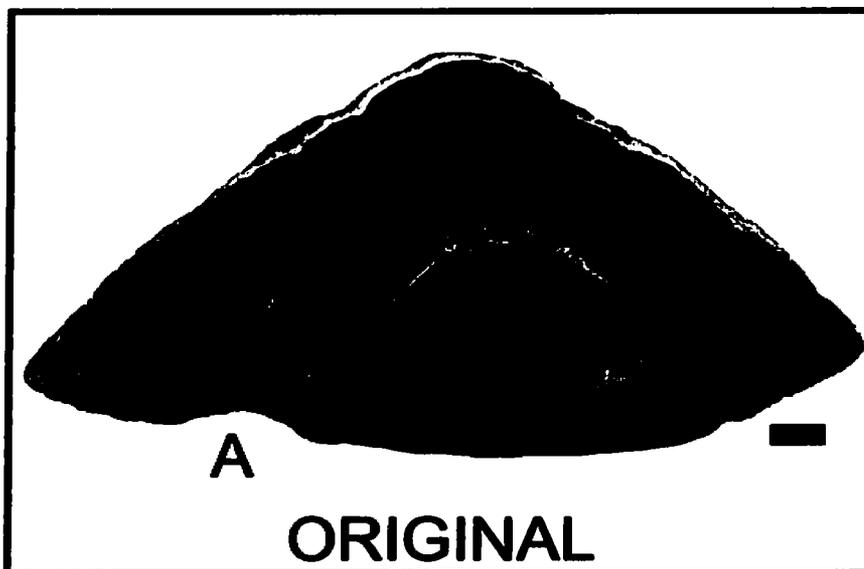
Void space



Bioeroded material



Skeletal substrate



Text-figure 4: Simplified images (B, C, D) of a vertical section of *Clathrodictyon* (A) record an increase in macrobioerosion for the upper centimeter (C) and central region (D) of the upper host stromatoporoid surface. Percent area of material removed by *Trypanites* borings shown below simplified images. Sample #1224, Locality A1188, Goéland Member, Jupiter Formation. Scale bar = 1 cm.

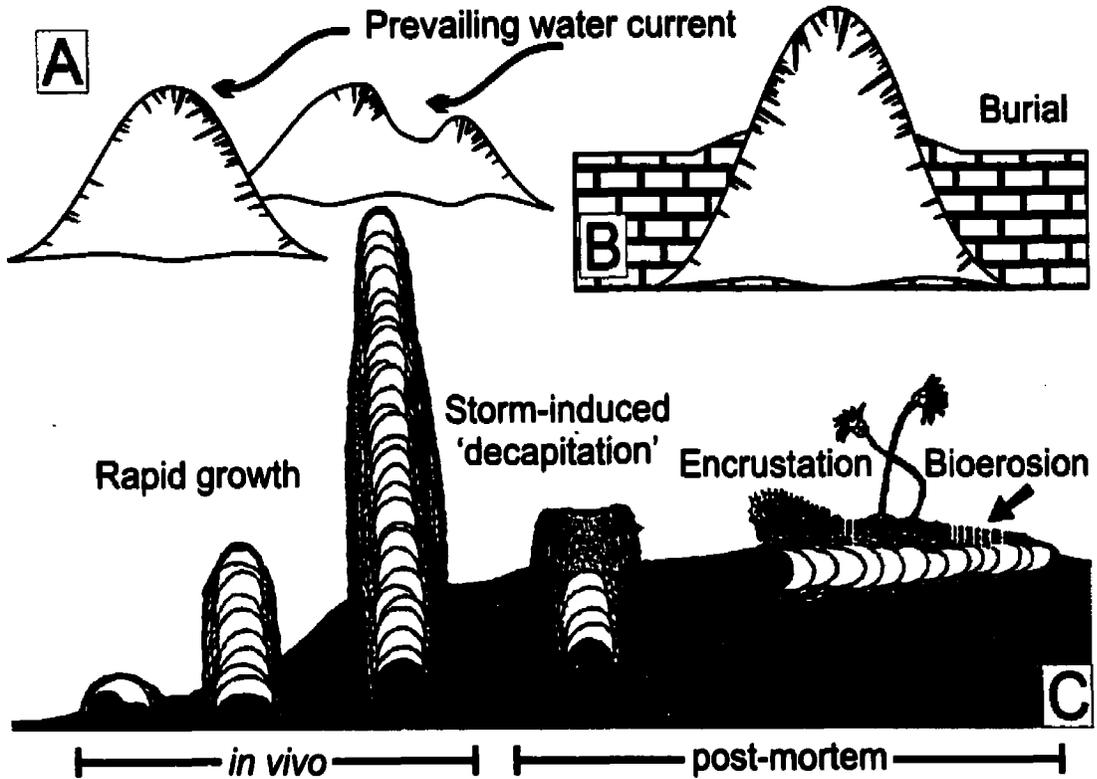
borings. Occasionally live hosts were bored (*in vivo*), as evidenced by deflected host growth around the damaged area of boring. In some rare instances, host deflection was extreme, resulting in chimney-like projections surrounding *Trypanites*. Many generations of *Trypanites* occur in some of the most intensely bored samples, e.g. *Clathrodictyon* from the Goéland Member. Even in these intensely bored samples, significant bioerosion by *Trypanites* rarely penetrates below the uppermost 2 cm of the substrate. *Trypanites* co-occurs with *Klemmatoica linguliforma* n. ichnogen. & ichnosp. and *Petroxestes pera* but not with *Chaetosalpinx rex* n. ichnosp. borings. Some *Trypanites* contain lingulids in life position within their cavities, similar to those found in *Klemmatoica linguliforma* n. ichnogen. & ichnosp. embedment structures. These are interpreted as nestlers, i.e. organisms which occupied a boring in which they did not make.

Since preservation of corals and stromatoporoids from Anticosti Island is generally very good, with the original low Mg-calcite of the tabulates and the slightly recrystallized fabrics of the stromatoporoids, borings are also well preserved. No specimens were dolomitized or silicified. Macroboring were predominantly made after the death, but before cementation, consolidation or lithification of the host substrate. As a result, margins of the unlined *Trypanites* are sharp in dense skeletons (e.g. *Acidolites*) and more ragged where skeletal pores or galleries are large (e.g. aulacerids, with a cystose coenosteum). In rare samples of aulacerids, borings have sharp edges excavated after the infilling of the outer microcysts by flocculent carbonate material (Cameron and Copper, 1994). It is uncertain whether this early cementation occurred prior to or immediately after the death of the columnar sponge. In highly porous (i.e. low skeletal density) tabulates such as *Favosites*, *Trypanites* are oriented lengthwise down the centre of corallites, cutting through tabulae. In this instance, the edges of the boring are sharp and defined by the corallite walls. *Trypanites* are either filled with carbonate sediment, calcite spar, or a combination of both resulting in a geopetal fabric of sediment at the bottom of the boring and spar along the vacant upper sides. The detrital sediment is usually silt to mud in size, but may range up to sand grade. The sediment is often well sorted, but where size varies, grading is normal. On occasion, fill has been reworked by bioturbation (Plate 1, figure 5) and may contain peloids likely of fecal origin. Sediment fill commonly contains detrital bioclasts including fragments of ostracodes, crinoid

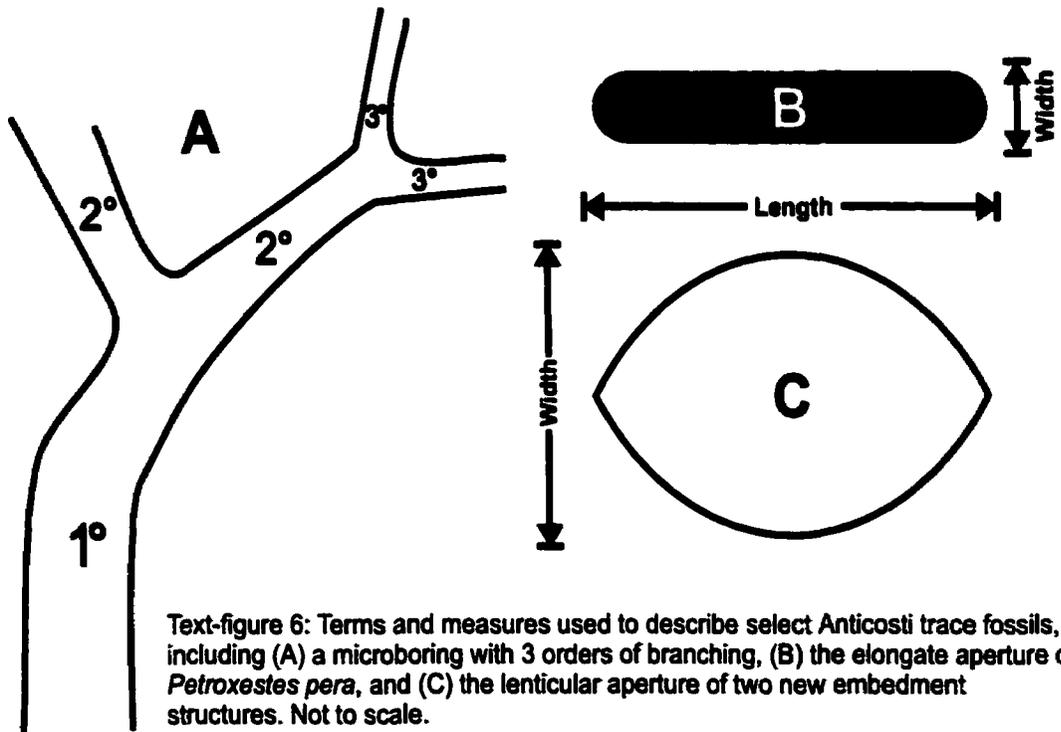
ossicles, bryozoans, trilobites, and brachiopods. Pyritization is commonly associated with boring fill, particularly concentrated at the base of the boring. Diagenetic haloes marked by discolouration or pyritization of the surrounding substrate also occur around some *Trypanites*. An exceptional *Trypanites* fill has been observed in three *Paleofavosites* from the Merrimack Formation (A1360, Plate 2, figures 1-4). Here, the borings cut through tabulae down the centre of corallites, and are discontinuously walled with mud which surrounds a central cavity filled with calcite spar. It is likely that the central cavity was filled with calcite spar after the surrounding detrital mud wall was deposited. In order for the central cavity to have remained unfilled by the surrounding mud, it is possible that an organism, e.g. soft-bodied worm, occupied the boring, although body fossil material is absent.

Discussion:

Trypanites is distinguished from *Gastrochaenolites* by its lack of basal swelling. Given the large number of *Trypanites* observed, it was not considered practical to designate ichnospecies for this study. However, it was observed that within a sample, *Trypanites* were roughly of equal diameter (± 2 mm). For example, a sample would not likely contain *Trypanites* having 9 mm and 1 mm diameters. Therefore, variability in *Trypanites* size was most significant between samples and between localities. These variations in *Trypanites* size appear to reflect differences in the maturity and composition of the boring community. Among the simplest of Recent macroborings, modern *Trypanites* is known to be made by a number of organisms, including polychaetes, sipunculids and phoronids (Rice, 1969), and by extension, many authors (Bromley, 1972; Kobluk et al., 1978; Pemberton et al., 1980; Kobluk and Nemscok, 1982) suggest that ancient *Trypanites* may also have been excavated by these worms. The high variability in *Trypanites* size among Anticosti Island samples would suggest several different causative organisms, but within a given sample or locality it is probable that only one type of borer was responsible. Though *Trypanites* were found in all types of corals and stromatoporoids, certain host substrates were bored more frequently. The distribution of *Trypanites* within a host coenosteum or corallum suggests a preference for the higher regions of the substrate, i.e. the upper centre of a domical substrate (Text-figure 5). To enhance suspension feeding and to reduce the likelihood of sediment burial,



Text-figure 5: Distribution of *Trypanites* within post-mortem host corals and stromatoporoids was dependent on host topography and position on the seafloor. Regions of the host facing into prevailing water currents and higher above the seafloor favoured suspension-feeding macroborers while reducing burial by sedimentation. Regions of the host buried in the sea bottom, e.g. bases of domical hosts (A, B) or one side of a storm-topped aulacerid stromatoporoid (C), remain unbored. Modified from Kobluk & Nemcsok, 1982; Nield, 1984; Cameron & Copper, 1994. Scale exaggerated.



Text-figure 6: Terms and measures used to describe select Anticosti trace fossils, including (A) a microboring with 3 orders of branching, (B) the elongate aperture of *Petroxestes pera*, and (C) the lenticular aperture of two new embedment structures. Not to scale.

Trypanites larvae may have actively selected sites facing into prevailing water currents for settlement (Kobluk and Nemcsok, 1982). As a result, the small-scale topography of the host substrate (e.g. prominences and valleys, Nield, 1984) controlled the local distribution of *Trypanites*.

Material:

Trypanites was found in 1,065 tabulates and stromatoporoids. Samples from all members, excluding the limited collection of the Innommée Member, contain *Trypanites*-bored substrates. Rawtheyan to Telychian. See Appendix C for locality information.

Ichnospecies *Petroxestes pera* Wilson and Palmer

Plate 3, figures 1-3

Petroxestes pera Wilson and Palmer, 1988: Figs. 1-2— Type specimen occurs in trepostome bryozoan from the Kope Formation (Edenian) of Boone County, Kentucky. Previously described from strata deposited in marine settings from Edenian to Richmondian (Cincinnatian, Caradoc to Ashgill, Late Ordovician).

Diagnosis:

Elongate, slot-shaped macroboring with roughly parallel sides, generally more than 10 mm long and 5 mm wide. Depth of boring into substrate may approach 14 mm. Sides of boring roughly parallel below the surface, until rounded into a blind base.

Description of *Anticosti* samples:

The aperture is elongate, with a variable length generally over 20 mm (Table 2; Plate 3, figure 1-2). The width is less variable in size, usually one-third to one-twentieth the aperture length (Text-figure 6). The depth of boring is variable, ranging from as shallow as 2 mm or to depths of 14.5 mm (Plate 3, figure 3). No lining or wall sculpture is present. Borings were located at the upper surface of the host substrate and penetrated perpendicular to the surface. Up to 10 borings occur in a single host skeleton, commonly clustered subparallel with a minimal spacing of 5 mm between aperture perimeters.

Paleoecology and taphonomy:

All *P. pera* borings appear to have been made after the death of the host. The repeated occurrence of *P. pera* in *Clathrodictyon* is likely due to the abundance of that stromatoporoid genus in the deeper water settings of the Goéland Member. Some *P. pera* occur with *Trypanites* and *Klemmatoica linguliforma* n. ichnogen. & ichnosp. (Plate 3, figure 2). In such instances, *P. pera* often truncates *Trypanites*, suggesting that *P. pera* is a later-stage boring (Plate 3, figure 1). No shell material has been found in these borings, rather, the large borings are filled with fine detrital sediments which often show bioturbation.

Discussion:

Described previously from the Caradoc and Ashgill (Wilson and Palmer, 1988; Pojeta and Palmer, 1976; Whitfield, 1893), and noted from the Middle Ordovician (C. Brett, personal communication, 2000), this is the first report of *Petroxestes pera* from the Silurian (Aeronian). *Corallidomus scobina*, a modiomorphid, facultative boring bivalve, was shown to have made *P. pera* (Pojeta and Palmer, 1976). It was thought to have byssally attached itself to the host substrate and with a side to side motion, ground itself into the substrate. Some *Clathrodictyon* from the Goéland Member have superficial (< 2 mm deep) traces similar in size and shape as *P. pera*. These likely are the primary stages of *P. pera* which were prevented from further excavation, possibly by rapid sediment burial. Such shallow traces have also been observed by Wilson and Palmer (1988). Although no shell material was preserved in the Anticosti Island samples, they are assumed to have been made by a species similar to *C. scobina*. Wilson and Palmer (1988) noted that *P. pera* most commonly occurred on the undersides of host substrates and that it appeared early in the ecological succession following the death of the host, subsequently being encrusted by bryozoans. This was not observed in the Silurian samples from the Goéland Member. *P. pera* is found in a number of Ordovician substrates including trepostome bryozoans, stromatoporoids, clayey nodules, and hardgrounds, and herewith from Silurian stromatoporoids. From these various substrates and as a facultative borer, *C. scobina* was not dependent on specific substrates or to the borer life habit. The rarity of *P. pera* in the Anticosti Island sequence suggests that environmental factors, rather than the substrate, were most critical

in controlling its distribution. Apparently, only in the muddy facies of the Goéland Member were environmental conditions favourable for *P. pera* excavation. To date, no bivalve borings have been found in the time interval between the Ordovician *P. pera* and the reported *Gastrochaenolites* from the Carboniferous (Wilson and Palmer, 1998).

Material:

Clear examples of *Petroxestes pera* were identified in 5 *Clathrodictyon*, but another 5 samples (4 *Clathrodictyon*, 1 ?*Pachystylostroma*) contain probable examples of *P. pera*. All five definitive *P. pera* borings are in *Clathrodictyon* from muddy Aeronian deposits of the Goéland Member (Jupiter Formation). The five definitive samples (#649, #1014, #1018, #1127, and #1219) are from localities A759, A1109c-2, A1188a, A1189d, and A1211. See Appendix C for locality data.

Problematic macroborings

Ichnogenus *Gastrochaenolites* Leymerie

Plate 3, figure 4

Gastrochaenolites Leymerie, 1842; redefined by Kelly and Bromley, 1984— Marine macroborings described from carbonates, e.g. hardgrounds, cobbles, reefal limestone. Arenig (Early Ordovician) to Recent.

Diagnosis:

Clavate macroboring in lithic substrates with narrow aperture and wide base. Borings range in size of diameter from 2 to 45 mm, and in length from 3 to 100 mm.

Description of Anticosti sample:

Only one boring resembling *Gastrochaenolites* has been observed in the Anticosti Island samples. Occurring at the upper surface of a *Clathrodictyon* sample from the Goéland Member (sample #1132, locality A835; Plate 3, figure 4), the boring extends to a depth of 2.6 cm. The 4 mm aperture flares to a 7 mm base, giving it a flask-like shape. *Gastrochaenolites* is a bivalve boring known to occur as early as the Early Ordovician (Benner and Ekdale, 1999). No shell has been found in the Goéland boring. The occurrence of *Petroxestes pera* in the Goéland Member suggests that bivalves were actively boring. The presence of ?*Gastrochaenolites* is therefore not

unexpected, but its sole occurrence raises the possibility of misidentification with common *Trypanites*.

Microborings

While the preservation quality of macroborings is relatively similar in tabulate and stromatoporoid hosts, microborings are more common in tabulates. This observation may be explained by (1) a lack of microborings in stromatoporoids, (2) the architecture of the stromatoporoid skeleton, or (3) by the diagenetic effect of recrystallization to low-Mg calcite in aragonitic stromatoporoids. Microborings were recognized by the presence of conspicuous fills, including (1) pyrite, (2) diagenetic micritic (i.e. automicrite, Neuweiler et al., 1999), (3) calcite spar, and (4) detrital micrite. The following microboring types were often characterized by their fills:

Sinuuous microborings

Plate 4, figure 5

Spar-filled microborings are observed in halysitid corals from reef and sandy off-reef facies of the Laframboise and Fox Point members (localities A41, A429, A590-7). The borings are cylindrical and meander subparallel to the corallite wall. Diameter ranges between 130 to 205 μm . Branches of uniform diameter rarely occur (Plate 4, figure 5). Taxonomic affinity uncertain.

Filamentous microborings

Plate 4, figures 1, 2, 4

Pyrite-filled microborings with an approximate diameter of 15 μm (Plate 4, figure 4). These ubiquitous traces are found in nearly all Anticosti carbonate substrates and are not confined to skeletal elements. These are the only microborings observed in stromatoporoids. In corals, the borings often occur in cemented pore spaces between skeletal elements, indicating that boring activity occurred well after the death of the host. An exceptional specimen of the tabulate coral, *Ellisites labechioides*, from a Prinsta Member reef (locality A1271) is intensely bored by spar-filled filamentous microborings (diameter 6.5 μm). The microborings penetrate roughly perpendicular to

the upper host surface to a depth of nearly 1 mm (Plate 4, figures 1-2). Borings may be straight or branched and are similar to unnamed algal boring descriptions by Kobluk and Risk (1977), Wood et al. (1990), and Elias and Lee (1993).

Globular microborings

Plate 4, figure 3

Spherical microborings filled with pyrite commonly occur in a number of host skeletons. These are especially common in Silurian halysitid coral walls, e.g. localities A1204 and A961 of the East Point Member, and A1306c of the Goéland Member. Borings are 15 μm in diameter and are often clustered (Plate 4, figure 3). It is likely that such clusters are interconnected and originate from an aperture at the host coral surface. Further, it is possible that these microborings are incompletely preserved filamentous microborings similar to those described above (Kobluk and Risk, 1977).

Ichnospecies *Reticulina elegans* Radtke

Plate 5, figure 1

Reticulina elegans Radtke, 1991: Tafel 7, Figs. 1-5; redefined by Bundschuh (2000)— Holotype described in Upper Eocene *Ostrea* oysters from Cuise-la-Motte, France. Also described from skeletal substrates, e.g. brachiopod shells and corals, ranging in age from Wenlock (Llandovery, Early Silurian) to Recent.

Diagnosis:

Reticulate, branched, microboring formed of tubes with diameter between 2 to 35 μm , forms zigzag network.

Branched microborings

Plate 5, figures 2-4

Description of Anticosti samples:

Branched microborings filled with micrite occur in densely walled *Acidolites* corals from the Prinista (A218), Laframboise (A363, A436-1, A436-3, A1194, A1191-1, A1191-2, and A1191-4), and Fox Point (A314) members. Boring tubes are roughly circular to oval in cross-section.

Borings most commonly initiate from the base of the host coral and branch upwards at acute angles subparallel to the corallite axis. With successive branching, boring diameter is reduced. Approximately three orders of branching (Text-figure 6; Plate 5, figure 3) are recognized from ranges in diametric size: primary 80 to 115 μm ; secondary 30 to 60 μm ; and tertiary 10 to 25 μm . Some branches terminate in a short crescentic stub, but most are elongate with a rounded end (Plate 5, figure 2). At the junction of some branches, an ovoid swelling roughly 100 μm in diameter is present (Plate 5, figure 4). Boring can be very intense in some *Acidolites*. These borings are nearly identical in description to those reported from the Middle Ordovician coralline red alga *Solenopora* from Québec and Norway (Pickerill and Harland, 1984) and tabulate coral *Protaræa* from Edgewood, Missouri (Young and Elias, 1995). Larger primary tubes are recognized in the Anticosti Island samples. Neither of the previous reports assign a name to the boring, but do suggest that it was generated by a sponge. Algae were not considered as the boring organism based on the large size of the borings (Pickerill and Harland, 1984). It is suggested here that algae should not be excluded as the producers of the borings. In all instances, the boring is present in a dense host skeleton and most commonly branches upwards from the base of the coral. It is likely that the borer required a dense medium in which to create its branched cavities. Upward branching of the boring suggests that it occurred *in vivo*: the boring may have been keeping pace with the growth of the host. Since the boring occurs in a dense medium, light penetration may have been a forcing limit on the borer. A phototropic response of the borer may account for the observation that the boring branches upwards rather than laterally. Since, evidence supports a photosensitive borer, algae should not be excluded as the possible boring agent.

These branched microborings are thought to resemble *Reticulina elegans* (J. Glaub and K. Vogel, personal communication, 2000). *R. elegans* is a dichotomously branching reticulate network similar to traces made by the modern chlorophyte, *Ostreobium quekettii* (Radtko, 1991). Found in substrates as early as the Silurian of Gotland, Sweden, the diameter of *R. elegans* tubes is between 2 and 35 μm (Bundschuh, 2000). For their differences in both size and reticulate networking of tubes, the microborings described by Pickerill and Harland (1984) are not

considered synonymous with *R. elegans* (M. Bundschuh, personal communication, 2000). Similarly, synonymy of the Anticosti Island branched microborings with *R. elegans* is tenuous. Detailed examination of these materials using the casting-embedding technique (Golubic et al., 1970) is required to draw any final conclusion in regards to their similarity to *R. elegans*.

Embedment structures

Ichnogenus *Chaetosalpinx* Sokolov

Plate 6, figure 1

Chaetosalpinx Sokolov, 1948: Figs. 1-2; =*Camptosalpinx* Sokolov, 1948: Figs. 3-5; =*Camptosalpinx* Plusquellec, 1968b: Textfigs. 1-2, Pl. 16, Figs. 5-6; *Chaetosalpinx* Stei, 1976: Figs. 9, 11-12— Holotype, *C. ferganensis*, described from Upper Silurian favositid tabulate coral, *Parafavosites ferganensis*, from the former USSR. Upper Silurian to Devonian.

Diagnosis:

Vertical tubicular cavity found in tabulate corals, often contained within a wall or septum of host, with margins of tube defined by host skeletal material. Linings and tabulae are absent.

Description of Anticosti samples:

The small tubicular structures invariably occur within the septa which form the corallite wall of the host *Columnopora* or *Calapoecia*. Diameters range between 0.09 and 0.3 mm. In one corallite, nearly all septa contain *Chaetosalpinx* ichnospp., but no more than one *Chaetosalpinx* structure occupies a single septum (Plate 6, figure 1). Longitudinally, the tube is continuous and spar-filled, and lacks tabulae. Enclosing the tube is a contiguous calcitic wall-lining roughly 0.1 mm thick. The wall microstructure is composed of radiating fibers, strongly resembling the trabecular microstructure of the coral septum.

Paleoecology and taphonomy:

Since the structure of the *Chaetosalpinx* wall strongly resembles coral trabeculae and no tabulae are observed within the tubes, *Chaetosalpinx* is considered to be an *in vivo* embedment structure (Plusquellec, 1968b; Stei, 1976). These authors proposed that an endosymbiotic worm occupied the cavity, but differed on whether the worm was harmless (commensalistic) or injurious

(parasitic) to the host coral. Preservation of *Chaetosalpinx* is often very good, and the structure is filled with clear calcite spar. Detrital mud does not appear to have penetrated the tubes. The wall surrounding the tube is also well preserved with a sharp contact between it and the inner spar-filled tube. No remains of the causative organism have been observed.

Discussion:

The most recent review of these Paleozoic embedment structures (Stel, 1976) has synonymized the large diameter (0.3-0.9 mm), sinuous *Camptosalpinx sibiriensis* with the straight ichnospecies of *Chaetosalpinx*. Under this new synonymy, straight *Chaetosalpinx* are divided by diametric size into the ichnospecies *C. huismani* (0.05-0.2 mm), *C. ferganensis* (0.2-0.3 mm), *C. groningenae* (0.3-0.4 mm), and *C. khatangaensis* (0.4 mm). No *Chaetosalpinx* has been described larger than 1.0 mm. As an embedment structure (Bromley, 1970), *Chaetosalpinx* is suggested to be reclassified properly under the ICZN as an ichnogenus, rather than its current (Howell, 1962) zoologic status.

According to the designation of ichnospecies by Sokolov (1948) and Stel (1976), the diameters of *Chaetosalpinx* observed in the Anticosti sarcinulids belong to *C. huismani* and *C. ferganensis*. The distinction of ichnospecies based solely on tube diameter is considered artificial since tubes of variable diameter frequently co-occur within the same host sample. Such distinction falsely implies diversity of ichnospecies and causative agents. It is more likely that small variations in diameter reflect growth of the commensal organism.

Tubes described as *Chaetosalpinx* have been widely reported from favositids of the Upper Silurian and Devonian (e.g. Sokolov, 1948; Plusquellec, 1968b; Stel 1976; Oekentorp and Brühl, 1999). While other embedment structures have been named from sarcinulid hosts (e.g. *Phragmosalpinx* in *Columnopora*, Plusquellec, 1968a), *Chaetosalpinx* tubes have only been informally discussed as unnamed foreign cavities commonly found in sarcinulid corallite walls and septa (e.g. Foerste, 1916; Flower, 1961; Jull, 1976). *Chaetosalpinx* described here from Anticosti *Calapoecia* and *Columnopora* formally extends the range of these embedment structures to the Rawtheyan stage (Ashgill, Late Ordovician).

Material:

Found in nearly all sarcinulid tabulate corals from Anticosti, including *Columnopora* and *Calapoecia*. Both sarcinulids and *Chaetosalpinx* occur up to the top of the Prinsta Member (Rawtheyan to Himantian, Ashgill, Late Ordovician). See Appendix B for occurrences of *Columnopora* and *Calapoecia*.

***Chaetosalpinx rex* ichnosp. nov.**

Plate 6, figures 2-4; Plate 8, figures 1-2; Text-figure 7

Etymology:

Rex, -king; named for its large diameter.

Type Locality:

A1399— Mill Bay Member, Vauréal Formation. Patch reefs ca. 10-15 m diameter, 1-2 m visible relief. Micritic reef core unbedded, with tops of reefs littered in abundant large ca. 30-40 cm diameter tabulate corals, (*Columnopora*, *Ellisites*, *Catenipora*, and *Paleofavosites*), large ca. 1-1.5 m diameter colonial rugose coral, *Paleophyllum*, and broken aulacerid stromatoporoids.

Range:

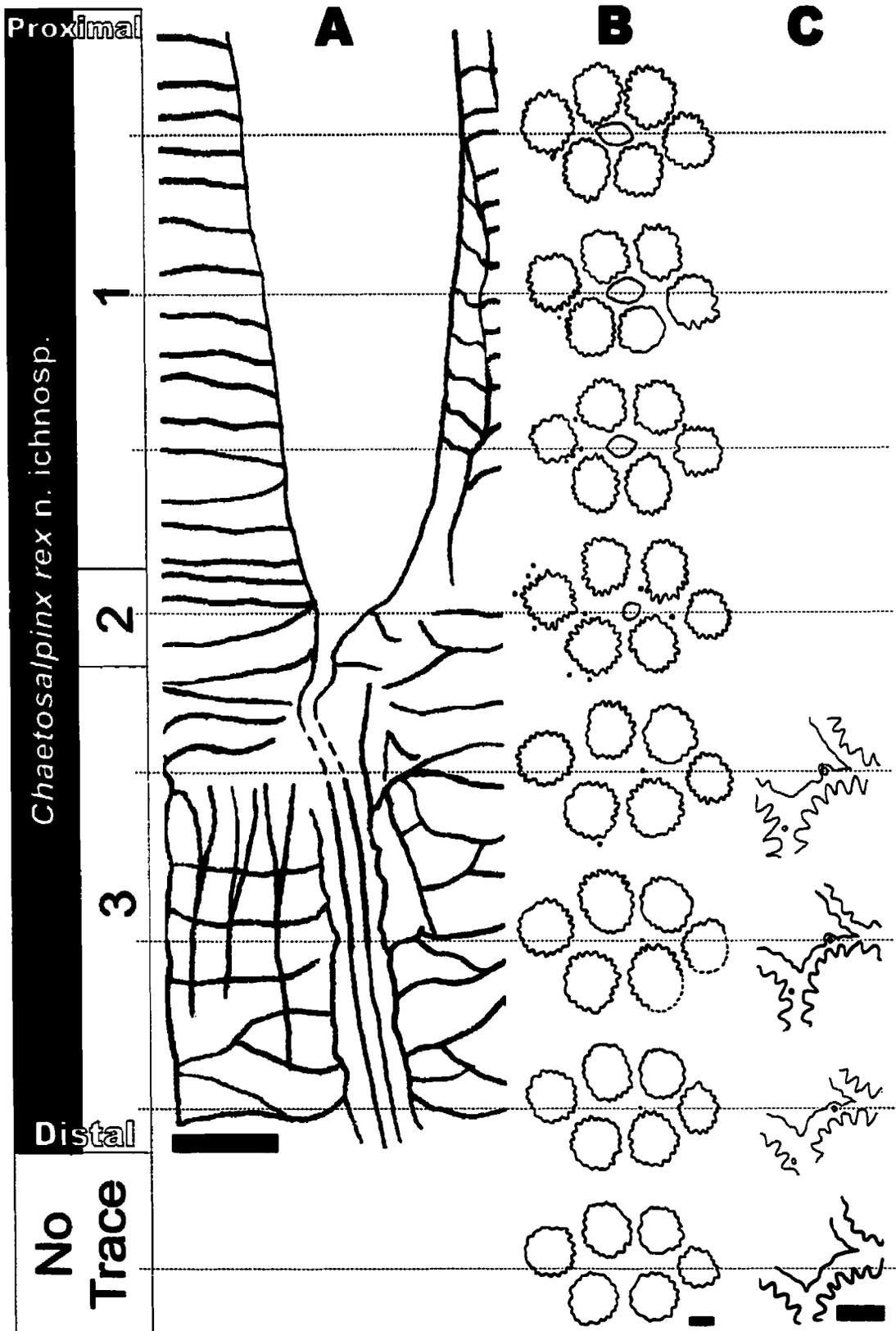
Rawtheyan (Ashgill, Late Ordovician) of Anticosti Island, Québec, Canada.

Diagnosis:

Straight *Chaetosalpinx* with large 5 mm lenticular aperture tapering to a small 0.3 mm circular base within the host skeleton of *Columnopora*. Tube is continuous through host to a depth of 35 mm below surface aperture.

Description:

The tube is divided into three distinct segments from proximal to distal (Text-figure 7). The proximal segment has a lenticular cross-section with a fairly constant width:length ratio of 0.6 (Table 2; Text-figure 6). The middle segment has a ragged-margin, circular cross-section and a diameter of less than 1 mm. The distal segment has a smooth margin and circular cross-section of less than 0.3 mm. Distally, this segment originates in the host coral septum. Proximally, the



Text-figure 7: *Chaetosalpinx rex* n. ichnosp. in coral host, *Columnopora*. A, Longitudinal section from sample #1048; B, Serial cross-section through sample #40; C, Detail of B. Dotted lines show approximate vertical position of serial sections relative to longitudinal section. Samples from Locality A1399, Mill Bay Member, Vauéal Formation. All scale bars = 1 mm.

distal segment diverts out of the coral septum and into either the intercorallite space or within the corallite. The tube widens into the ragged middle segment. In some instances, the tube ends with the middle or distal segment at the aperture. In others, the middle segment flares upwards to form the distinctive lenticular aperture of proximal segment 1 (Plate 6, figure 2). The deepest tube structure may be over 35 mm. Depth of individual segments is highly variable, but their general path parallels the corallite growth axis. Walls surrounding the tube are composed of tabulate coral skeletal elements, likely epitheca, deposited by the host *Columnopora*; they are nearly 130 μm thick, and made of trabecular calcite. Annuli are occasionally visible on the inside face of the proximal segment 1. Up to 10 lenticular apertures occur per 4 sq. cm of the host *Columnopora* surface.

Paleoecology and taphonomy:

Chaetosalpinx rex n. ichnosp. is most likely a parasitic or commensal structure, not a boring. The embedment structure is often exposed at the upper surface of the coral, or has been overgrown. It is never found on the undersides of the coral. *C. rex* always extends parallel to the coral growth axis. Adjacent corallites are sharply deflected by *C. rex*, almost appearing as if they were truncated (Plate 6, figure 4). As an embedment structure, *C. rex* was formed by the sequestration of an endosymbiotic organism by the living coral host, *Columnopora*. The process of initial occupation by the endosymbiont within the host coral septum is unclear. Based on growth bands in the host skeleton, *Chaetosalpinx rex* could be sustained in a living coral for at least 4 years. The age of the tubes, however, is limited by the longevity of the host.

It is suggested that the initial development of *C. rex* began in the same way as other *Chaetosalpinx*. With the second, middle stage of growth, the tube was forced outside the confines of the coral septum (Text-figure 7). The middle segment defines the transition zone towards the final biconvex segment (Plate 6, figure 3). It is uncertain why the middle segment has a ragged wall, as it is situated in intercorallite space, surrounded by four corallites. With growth into the proximal segment 1, it may be surrounded by up to six corallites (Plate 6, figure 4). Without careful examination, tubes appear to truncate corallites. Deflection only affects skeleton immediately adjacent. Reduced coral septal spines commonly extend from the wall of the

embedment structure into corallites, proving that the wall was made by the host. The tube is usually filled with calcite spar and micritic mud. No direct evidence of the soft or hard parts of the endosymbiont have been found.

Comparison:

Although diametric size is considered an artificial diagnostic character for separating other *Chaetosalpinx*, *C. rex* n. ichnosp. can be more than ten times larger than the largest described straight *Chaetosalpinx*. In addition, towards its maturity, *C. rex* has a distinct lenticular aperture unknown in other ichnospecies of *Chaetosalpinx*. The distal segment of *C. rex* is indistinguishable from *C. huismani* and *C. ferganensis*, in both diameter and morphology. The abrupt intersection of the biconvex wall with adjacent corallites is similar to *Chaetosalpinx* (= *Camptosalpinx*) *sibiriensis* (Sokolov, 1948, Figs. 4-5). Unlike *Chaetosalpinx sibiriensis*, *C. rex* does not meander across corallites throughout its depth. The only horizontal component of *C. rex* is at the transition from distal segment 3 to middle segment 2, when it exits the coral septum. The three different types of cross-sectional aperture morphologies of *C. rex* observed on the host surface reflect the maturity of the endosymbiont at the time of death. The smallest (~0.3 mm) circular aperture (segment 3) is considered the youngest form, the ragged, ~1 mm aperture (segment 2) is an intermediate form, while the larger lenticular aperture (segment 1) is characteristic of a mature *C. rex*.

Material:

Chaetosalpinx rex occurs only in *Columnopora*. Four *Columnopora* samples (#40, #1035, #1048, and #1051) bearing *Chaetosalpinx rex* n. ichnosp. are from a single reefal locality (A14 = A1399) in the upper Mill Bay Member of the Vauréal Formation (Rawtheyan).

Holotype: Sample #40— Embedment structures occur in domical *Columnopora* (20 cm diameter, 10 cm high). Locality A1399, Mill Bay Member, Vauréal Formation, Anticosti Island, Canada.

Paratypes: Samples #1035, #1048, and #1051, from one locality referred to as either A14 or A1399— Mill Bay Member, Vauréal Formation, Anticosti Island, Canada.

Ichnogenus *Klemmatoica* nov.

Etymology:

Klemmatos, -stolen; *oikos*, -house; Reflects the occupation and modification of a previously made boring by a nestler.

Type ichnospecies:

Klemmatoica linguliforma ichnosp. nov.

Type locality:

A1179— Goéland Member, Jupiter Formation. Soft weathering, blue-grey calcareous mudstones and micrites with large *Pentamerus*, *Joviatrypa*, and *Triplesia* brachiopods.

Range:

Aeronian (Llandovery, Early Silurian) of Anticosti Island, Québec, Canada.

Diagnosis:

Embedment structure with lenticular cross-section, up to 4.9 mm, extending from proximal circular aperture of *Trypanites* Mägdefrau excavated in skeletal host substrate. Embedment structure extends up to 6 mm from *Trypanites* aperture; combined length of *Trypanites* and embedment structure form cavity up to 26 mm in length.

Comparison:

The embedment structure is clearly distinguished in its formation from all borings which may have a similar aperture morphology. The base of the embedment structure is connected to the proximal end of *Trypanites*. In cross section, the embedment structure is lenticular, while *Trypanites* is circular. In longitudinal section, host skeletal elements deflect adjacent to the embedment structure, but are truncated by *Trypanites*.

Klemmatoica linguliforma ichnosp. nov.

Plate 7, figures 1-5; Plate 8, figures 3-6; Text-figures 8, 9

Etymology:

Linguli, -lingulid; *forma*, -form. Name reflects its formation by a nestling lingulid brachiopod.

Diagnosis:

Klemmatoica formed by a lingulid brachiopod extending from the proximal aperture of *Trypanites* Mägdefrau in a host heliolitid tabulate coral or stromatoporoid skeleton.

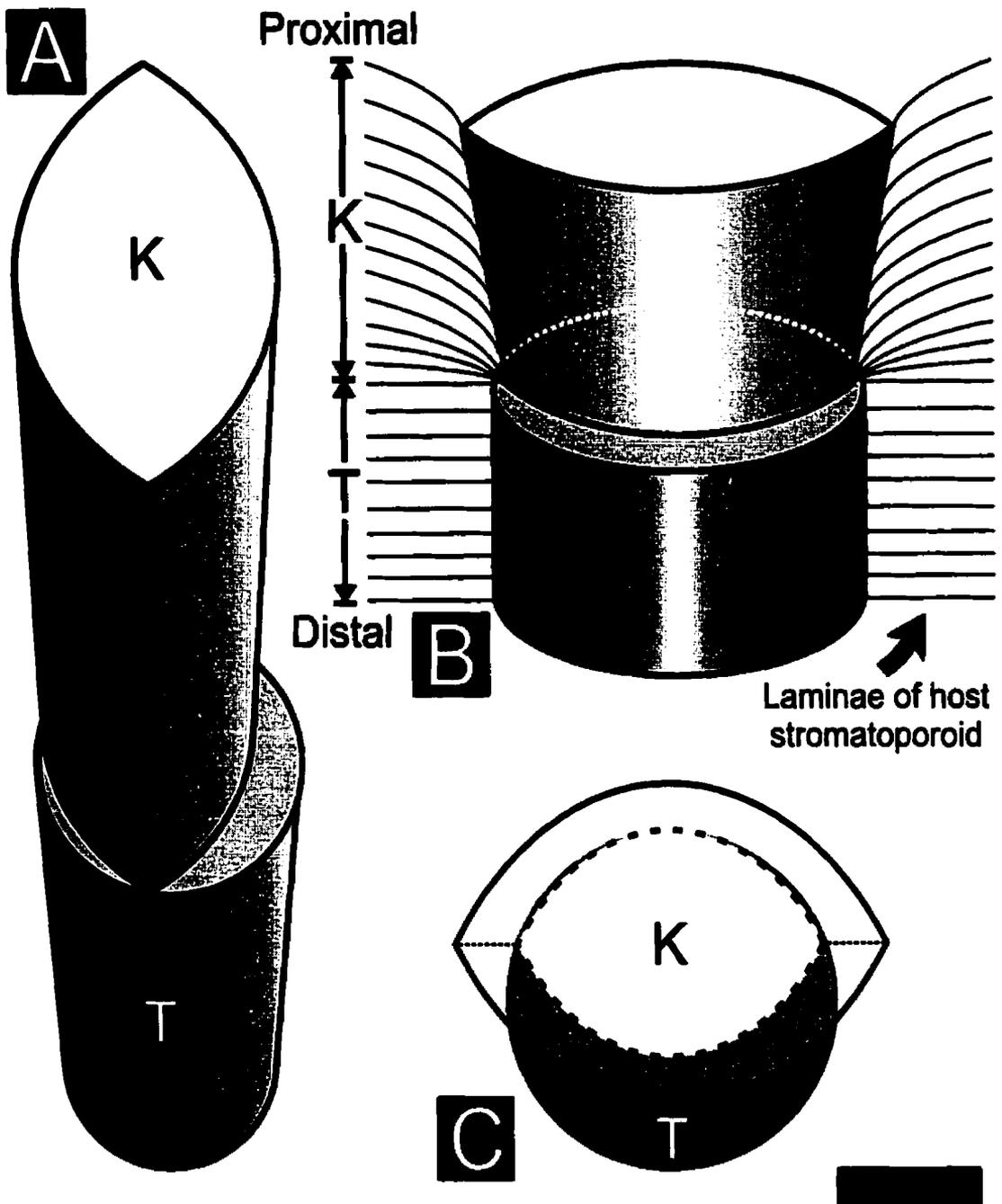
Description of studied samples:

This tubicular structure extends from the proximal end (i.e. former surface aperture) of some *Trypanites*, forming a continuous cavity in the host coral or stromatoporoid substrate (Text-figure 8). *Trypanites*, noted by its circular cross-section and truncation of host skeletal elements (e.g. stromatoporoid laminae), differs from the lenticular cross-section edged by deflected skeletal elements typical of the tubicular extension. Dimensions of the lenticular aperture (Table 2) range up to 4.9 mm along the long-axis and 3.4 mm along the short-axis. The lenticular aperture is distinctive, having a consistent width:length ratio of 0.7 (Plate 7, figure 1). No lining occurs in the tubicular extension, but rather the walls are formed by the deflected host skeleton. In some instances, a low relief ridge of deflected host skeleton may rim the aperture (Plate 8, figures 3, 4, 6). All tubicular extensions occur at the upper surface of the host coral or stromatoporoid skeleton, often in minor depressions, and are oriented perpendicular to the surface. The tubicular extensions occur at up to 7 per 4 sq. cm. In nearly all examined extended-*Trypanites* cavities, lingulids are found preserved in life position, i.e. posterior down (Plate 7, figure 4).

Paleoecology and taphonomy:

The tubicular structure represents the extension of a pre-existing *Trypanites* boring in a live host coral or stromatoporoid skeleton. The deflection of host skeletal elements edging *Klemmatoica linguliforma* n. ichnogen. & ichnosp. strongly suggests that it was made in a living host coral or stromatoporoid. The presence of intact lingulid shells in life position indicate that the lingulid was responsible for the formation of the tubicular extension. *K. linguliforma* may be the only trace fossil at the surface of the host coral or stromatoporoid substrate (e.g. as seen in sample #1022 from locality A1179). More commonly, it is associated with other surface traces, especially *Trypanites*, but occasionally *Petroxestes pera*.

Exposed at the upper host surface, extended-*Trypanites* cavities are usually filled with detrital mud (Plate 7, figure 3), but where the structure has been overgrown, either by the host or another



Text-figure 8: Models of an extended-*Trypanites* cavity formed of two parts: a basal *Trypanites* boring (T) connected proximally to the surface of the host substrate by an embedment structure (K), *Klemmatoica linguliforma* n. ichnogen. & ichnosp. Proposed mechanism for the formation of this compound structure illustrated in Text-figure 9. A, Three-dimensional cast of extended-*Trypanites* cavity. B, Profile of extended-*Trypanites* cavity in a host stromatoporoid skeleton. Laminae are truncated by *Trypanites*, but are deflected downwards at the margin of the embedment structure. C, Overhead view of extended-*Trypanites* cavity. All diagrams are idealized models based on serial-sections. Scale bar = 1 mm.

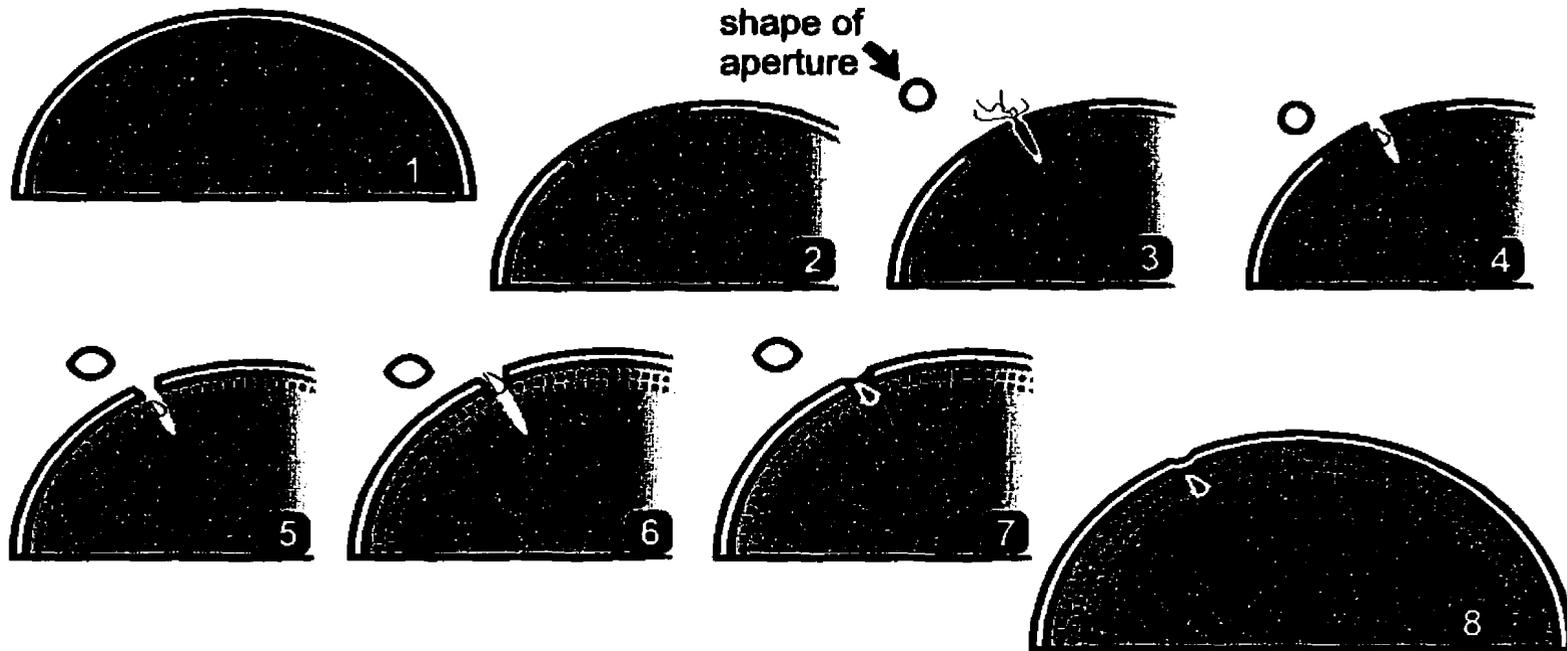
encruster, it is spar-filled. Lingulids are often preserved intact with both valves in life position, but occasionally their valves are broken and displaced. Three or four lingulids have been found in a single cavity, although solitary occupation is most common. The lingulids are not considered to have made the *Trypanites*, but rather to have occupied a previously made boring, i.e. the lingulids are nestlers.

Discussion:

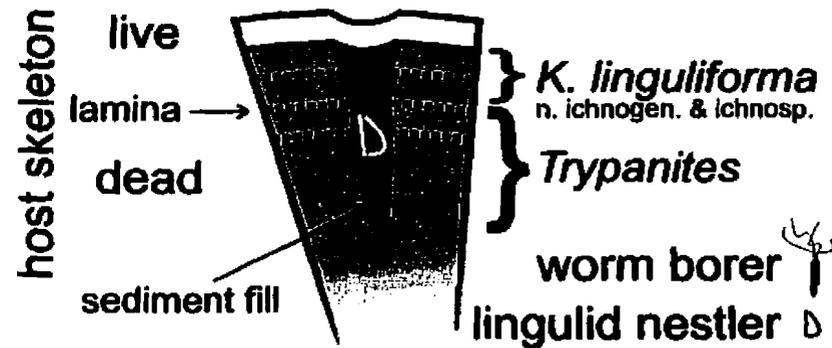
In 40 samples, lingulid shells have been found inside unmodified and extended-*Trypanites* cavities. These hosts include heliolitids and stromatoporoids from Ordovician and Silurian strata. Only one possible lingulid shell fragment has been found in *Paleofavosites*. Though one sample was from the sandy facies, all others were from muddy facies. The lingulid is convex to planar, with a thin, phosphatic shell, and its maximum posterior-anterior (length) and ventral-dorsal (depth) measurements are 7.1 and 3.0 mm, respectively, but are most commonly around 3.5 mm long and 1.6 mm in depth. In some rare examples (samples #1022 and #2474), the remnants of a pedicle appear to have been preserved as calcite spar surrounded by micritic fill, extending from the posterior of the lingulid to the base of the extended-*Trypanites* cavity (Plate 7, figure 4). The brachiopods resemble a species related to the lingulid genus *Rowellella* (L. Holmer, personal communication, 2001).

The depth of the lingulid spatially corresponds to the short-axis (width) of the *K. linguliforma* aperture. With a maximum width of 3.4 mm, the aperture is large enough to house the depth (maximum = 3 mm) of the lingulid. Additionally, the anterior cross-section of the lingulid is lenticular in shape. Therefore, it is concluded that the lingulid was responsible for the expansion of the *Trypanites* cavity to form *Klemmatoica*. Since no boring mechanism, aside from pedicle attachment scars such as *Podichnus*, exists for brachiopods and since *Klemmatoica* was clearly made *in vivo*, it is suggested that the lingulid acted as a passive borer (sensu Scoffin and Bradshaw, 2000). Therefore, *K. linguliforma* is an embedment structure (Bromley, 1970).

The following postulates a method by which *Klemmatoica* structures were formed. Since the majority of these structures occur in stromatoporoids, *Clathrodictyon* will be used as a model host substrate. Each step is illustrated in Text-figure 9.



Text-figure 9: Proposed sequential model of the formation of an extended-*Trypanites* cavity in a stromatoporoid by a nestling lingulid brachiopod. Embedment structure, *Klemmatoica linguliforma* n. ichnogen. & ichnosp., produced by deflection of host stromatoporoid laminae around lingulid brachiopod. In this model, *Trypanites* is considered to have been excavated by a 'worm' (sipunculid or polychaete). Cross-section of cavity aperture shown above left corner of host stromatoporoid. Thickness of stromatoporoid laminae exaggerated. See text for detailed explanation.



Step 1: A healthy domical *Clathrodictyon* grows on the seafloor. Note that, like all stromatoporoids, only the outermost skeleton of the sponge contains living tissue (white) which overlies the dead (grey) basal skeleton. The aragonitic skeleton of *Clathrodictyon* consisted of thin (ca. 0.1 to 0.25 mm) laminae of imperfect cyst plates.

Step 2: For a variety of reasons, such as disease or momentary burial, an area of the living stromatoporoid soft tissue dies and becomes exposed.

Step 3: The dead surface, now available to the macroboring community, is bored by a *Trypanites* organism (e.g. sipunculid). At this point, a post-mortem *Trypanites* with a circular aperture is formed. Note that no host skeletal deflection has occurred.

Step 4: The *Trypanites* is vacated by the sipunculid and replaced by a nestling lingulid. The original displacement of the sipunculid may have been dependent on the lingulid, since possibly the lingulid parasitized the worm (e.g. by being ingested?) or forcibly evicted it. If the sipunculid acted as an attractant for the lingulid larva, then it would provide an explanation for how the larva came to find a tiny and vacant refuge in a dead host substrate. Regardless, numerous examples of a lingulid in circular-apertured *Trypanites* have been found. In most cases, the sequence ends here for the lingulid, at Step 4 in a dead host substrate.

Step 5: After a hiatus in growth, the *Trypanites*-bored stromatoporoid surface is reactivated (a death and overgrowth surface). By some mechanism, the lingulid is able to inhibit the growth of the stromatoporoid, causing deflection of laminae proximal to its shell. The deflected growth around the shell creates an embedment structure, *K. linguliforma*, with a lenticular aperture. Note that the *Trypanites* is not altered in any way, but rather *K. linguliforma* extends from the proximal end of *Trypanites* to the top of the rising host surface.

Step 6: As the stromatoporoid continues to grow, the lingulid is able to grow and position itself higher in the cavity by using its retractable pedicle. A number of *K. linguliforma* have been found with a lingulid poking out of the aperture.

Step 7: Rapid sedimentation may bury the lingulid, presumably alive, in its cavity; or, (Step 8) if the lingulid died or was not able to keep pace with the host, the stromatoporoid would overgrow the structure, leaving a small depression above the *Klemmatoica* cavity.

Lingulids have been described from borings in Late Silurian heliolitids and stromatoporoids from Wales (Newall, 1970) and Sweden (Richards & Dyson-Cobb, 1976). Both accounts regarded the lingulid as a nestler (i.e. not a borer) and remarked on host deflection, causing raised 'chimneys', and oval apertures. No attempt was made to name the embedment structures. From their figures, it appears likely that some borings were modified with structures similar to *K. linguliforma*. Newall (1970) suggested that lingulid larvae were introduced to preformed borings by settling on sediment covering the borings. It is suggested here that larvae may have been attracted to the borers, either chemically or by behaviour. This would provide the means for locating miniscule, but highly advantageous refugia. Once established, the lingulids appear to have been either gregarious, or to have lived serially in the same hole. Though not common, lingulids associated with corals and stromatoporoids were locally very abundant. An estimated 200 lingulids may occur in one single stromatoporoid (e.g. sample #1022 from locality A1179). In addition to Anticosti Island, Wales, and Sweden, lingulids have been found in Upper Ordovician *Columnopora* from Manitoulin Island, Ontario. No *Klemmatoica* are associated with the Manitoulin Island samples. Nestling lingulids were a widespread phenomenon in the Ordovician and Silurian. Unless similar examples of nestling lingulids have been overlooked, it is unclear why a seemingly favourable life habit was not perpetuated in one of the longest lived groups of animals.

Comparison:

While both *Klemmatoica linguliforma* n. ichnogen. & ichnosp. and *Chaetosalpinx rex* n. ichnosp. are embedment structures with similar aperture morphology, they are not considered synonymous. Significant differences in morphology, host interaction, affinity of the tracemaker, and facies occurrence support the separation of these ichnospecies under two distinct ichnogenera.

The distal base of *C. rex* is two to three times narrower than the base of *K. linguliforma* (Plate 6, figure 4; Plate 7, figure 5). Although width:length ratios of *C. rex* and *K. linguliforma* are similar, irregular lenticular apertures are more frequent in *K. linguliforma*. In the heliolitid host, *K. linguliforma* have a more circular lenticular aperture. In instances where two *C. rex* lenticular apertures neighbour closely, both remain partitioned by a wall (Plate 8, figure 1). Conversely, two

adjacent *K. linguliforma* apertures may overlap without partition (Plate 7, figure 2; Plate 8, figures 4-5). This results in adjacent, separate borings producing a large compound opening at the host surface. Such amalgamations have not been observed in *C. rex*.

Originating as a small embedment within a coral septum, *C. rex* appears to be integrated within its host *Columnopora* more intimately than does *K. linguliforma* in its stromatoporoid or heliolitid host. This more integrated relationship between host and embedment structure is similar to the commensal tube, *Chaetosalpinx sibiriensis*. Both *C. sibiriensis* and *C. rex* sharply deflect only host corallites immediately proximal to their tubes. Deflection is so precise as to resemble truncation. Conversely, heliolitid corallites rarely form immediately adjacent to *K. linguliforma*, instead coenenchymal skeleton surrounds the embedment aperture (Plate 8, figure 4). In the few examples where heliolitid corallites are close to the *K. linguliforma* aperture, they are weakly deflected (Plate 8, figures 3, 6). The differing responses between the hosts of *C. rex* and *K. linguliforma* suggest different symbiotic relationships between host and nestler. In the case of *C. rex*, though deflected to accommodate the nestler, corallites are not repelled. This suggests a commensal (mutually harmless) or mutualistic (mutually beneficial) relationship between *Columnopora* and *Chaetosalpinx rex*. In the heliolitid bearing *K. linguliforma*, corallites tend to be repelled from the embedment, suggesting that the lingulid was an irritant which needed to be sequestered. It is unlikely that the lingulid was significantly injurious to the coral host, but rather was an unwanted guest, i.e. commensal.

It is unlikely that *C. rex* was generated by a nestling lingulid. Such lingulids have only been recovered from off-reef facies, thus far never in reefal stromatoporoids and corals (Richards & Dyson-Cobb, 1976; Newall, 1970). In addition, the size of the *C. rex* base appears too small to accommodate a larval lingulid. The smallest shell recovered from *K. linguliforma* was at least 1 mm wide. As in other *Chaetosalpinx*, *C. rex* was probably made by a commensal worm.

Accounts of symbionts in Ordovician and Silurian corals and stromatoporoids are rare. Different vermiform tubes are reported from solitary rugose corals (Clarke, 1921; Elias, 1986). Symbiotic relationships are more widely reported in the Devonian and are still dominated by worms (Kravtsov, 1966; Stel, 1976; Oliver, 1983), but also include barnacles (Clarke, 1921).

Material:

Ten samples, including 9 *Clathrodictyon* and 1 heliolitid coral (?*Propora*), contain *K. linguliforma*. These samples are all from the muddy facies of the Goéland Member (Aeronian). Samples include #650, #653, #662, #672, #1014, #1022, #1047, #1122, #1126, #1135, #1220, and #2474, and are from localities A734, A759, A769, A846, A846c, A1109c-2, A1164b, A1179-1, A1188, A1188c, A1189b, and A1391. See Appendix C for locality data.

Holotype: Sample #1022— Embedment structures occur in domical *Clathrodictyon* (29 cm diameter, 18 cm high). Locality A1179, Goéland Member, Jupiter Formation, Anticosti Island, Canada.

Paratypes: Samples #650, #653, #662, #672, #1014, #1047, #1122, #1126, #1135, #1220, and #2474 from localities A734, A759, A769, A846, A846c, A1109c-2, A1164b, A1188, A1188c, A1189b, and A1391— Goéland Member, Jupiter Formation, Anticosti Island, Canada.

Ichnotaxon	Aperture Size Ranges (mm)		Max. Depth (mm)	Max. Intensity (per 4 sq. cm)	Width/Length ratio at aperture
	Width	Length			
<i>Trypanites</i>	0.65 - 9.53	0.65 - 9.53	52.81	35	~1
<i>P. pera</i>	3.01 - 6.62	13.29 - 48.11	14.53	2	0.05 - 0.3
<i>C. rex</i>	0.28 - 2.96	0.36 - 5.67	35.98	10	0.6
<i>K. linguliforma</i>	1.24 - 3.43	1.67 - 4.90	26.67	7	0.7

Ichnotaxon	Structure	Host	Facies	Stage	No. studied samples (hosts; traces)
<i>Trypanites</i>	boring	all	all	all	1,065; 10,000+
<i>P. pera</i>	boring	<i>Clathrodictyon</i>	sandy, muddy	Aeronian	5; ~20
<i>C. rex</i>	embedment	<i>Columnopora</i>	reef	Rawtheyan	4; ~100
<i>K. linguliforma</i>	embedment	<i>Clathrodictyon</i> , <i>?Propora</i>	sandy, muddy	Aeronian	9; ~60

Table 2: Summary of macroborings and embedment structures from Anticosti Island. Aperture measurements for select traces illustrated in Text-figure 6.

Comparison of ancient vs. modern bioeroders in tropical marine carbonates

Bioerosion in Anticosti corals and stromatoporoids are here recognized to include macroborings, dominated by *Trypanites* with rare occurrences of *Petroxestes pera*, and several microboring morphotypes. The absence of body fossils preserved in the borings does not allow a

conclusive list of Anticosti borers to be made, however, these likely included worms (e.g. sipunculids and polychaetes), bivalves, and microbes (algal, fungal, and bacterial). Notable absentees, such as sponge borings (e.g. *Clionolithes* and *Topsentopsis*) and traces of excavating grazers, may have occurred in such unexamined substrates as brachiopod valves and nautiloid shells or were hidden as cryptobionts (e.g. Kobluk, 1981b).

While *Trypanites* has remained common throughout most of the Phanerozoic, even in the Holocene, modern bioeroders appear to have been more diverse and more destructive than in the Paleozoic. Microborers (algal, fungal, and cyanobacterial) rapidly infest substrates and are among the most significant bioeroders occurring in all marine environments, including abyssal settings (Boerboom et al., 1998), and this is probably also true of the Paleozoic (Vogel, 1995). Volumetrically, urchins and scarid fish are significant bioeroders, recycling carbonates while feeding on endolithic algae (Chazottes et al., 1995). Modern reef and tropical shoreline macroborers are usually dominated by clionid sponges, followed by bivalves and worms (Pleydell and Jones, 1988). The large, networked chambers excavated by boring sponges are generally confined to the upper 2 cm of the hard substrate (Wilkinson, 1983). Roughly 98% of this excavated material is redistributed as silt-sized chips (Hutchings, 1986). Though locally abundant, the discrete deep borings made by bivalves are less significant in the erosion and recycling of Holocene carbonates than sponge borings. In modern bioerosion, sipunculid and polychaete borings are similar in their abundance and boring intensity to bivalves. Generally confined to the upper 2 cm of the hard substrate, worm borings are generally not as effective as sponges in removing and recycling carbonate substrates (Pleydell and Jones, 1988): this may also depend on facies. Sipunculids are not initial colonizers of newly exposed hard substrates (Davies and Hutchings, 1983; Peyrot-Clausade and Brunel, 1990). First appearing after 1 year of exposure (Chazottes et al., 1995), sipunculids are only abundant to 2 cm depth after 2-3 years (Hutchings, 1986). Polychaetes are more rapid colonizers, arriving within 2 months of substrate exposure (Chazottes et al., 1995).

Trypanites, likely made by sipunculid or polychaete worms, characterize most bioerosion in the Anticosti Island sequence. By using colonization rates known from the modern, exposure time of

ancient hard substrates containing *Trypanites* could be estimated. At present, extrapolation from experimental data is limited since *Trypanites* may have been made by either early (polychaetes) or late (sipunculids) colonizers. Until the traces can be linked to a specific organism, the low resolution of modern colonization rates will not be helpful in describing hard substrate exposure time.

FREQUENCY AND INTENSITY OF ANCIENT MACROBIOEROSION

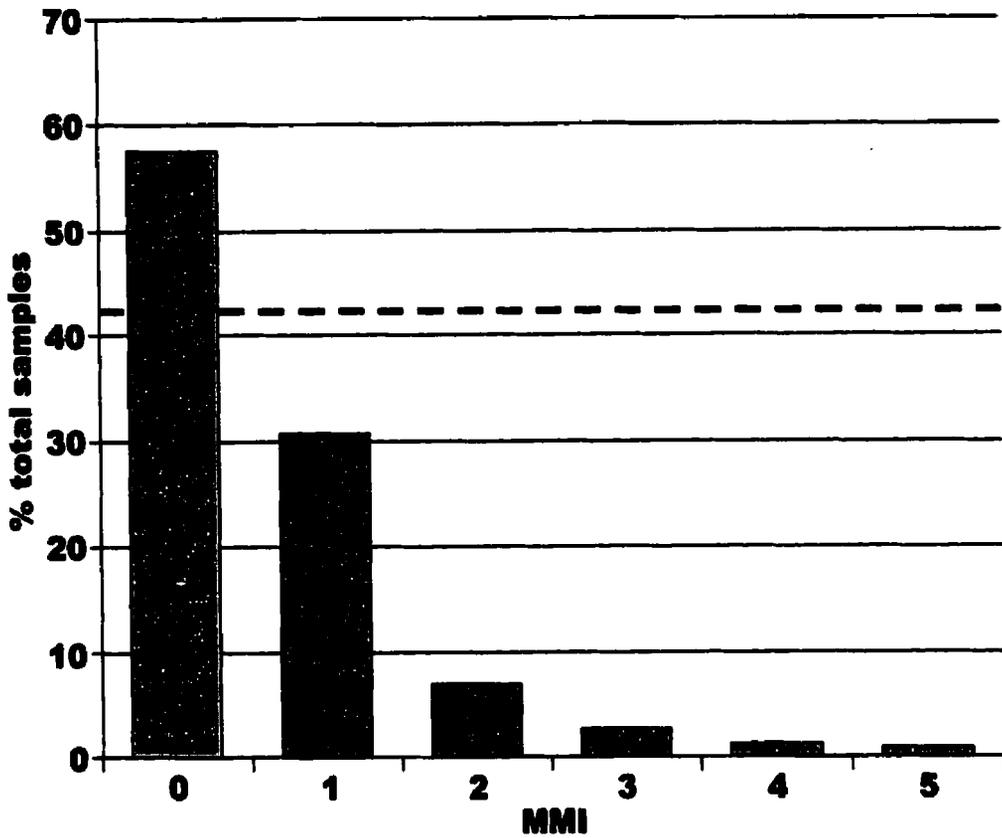
The frequency (number of cases reported) and intensity (number of borings per unit area) of boring are a debated issue for the Paleozoic. For example, Paleozoic bioerosion is thought to be minimal in reefal settings (Wood, 2000), but is commonly reported from hardgrounds (Palmer, 1982). Evidence from Anticosti material suggests that Early-Middle Paleozoic bioerosion was a common process in many settings within a tropical marine carbonate ramp.

All samples

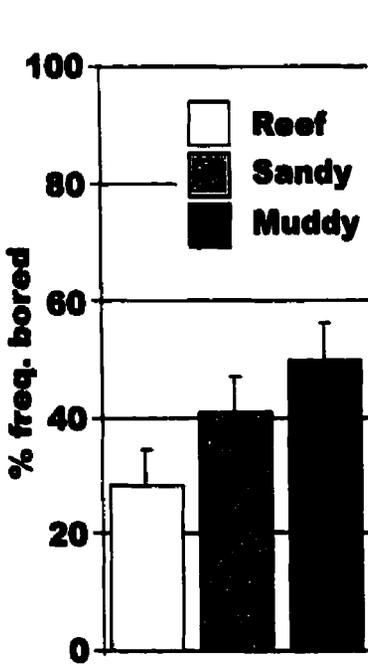
Over 42% of the 2,528 samples are macrobored and three-quarters of those bored samples have fewer than 5 borings per 4 sq. cm (MMI = 1: Text-figure 10). The highest boring intensity (MMI = 5) occurs in less than 1% of all samples. These data suggest that bioerosion was a common process, affecting 2 out of every 5 massive tabulates and stromatoporoids, but high boring intensity was generally rare. To explore the scope of these basic observations, the frequency of macroborings (see **Methodology** for calculation) was determined for environmental (external) and substrate-specific (internal) variables.

External variables

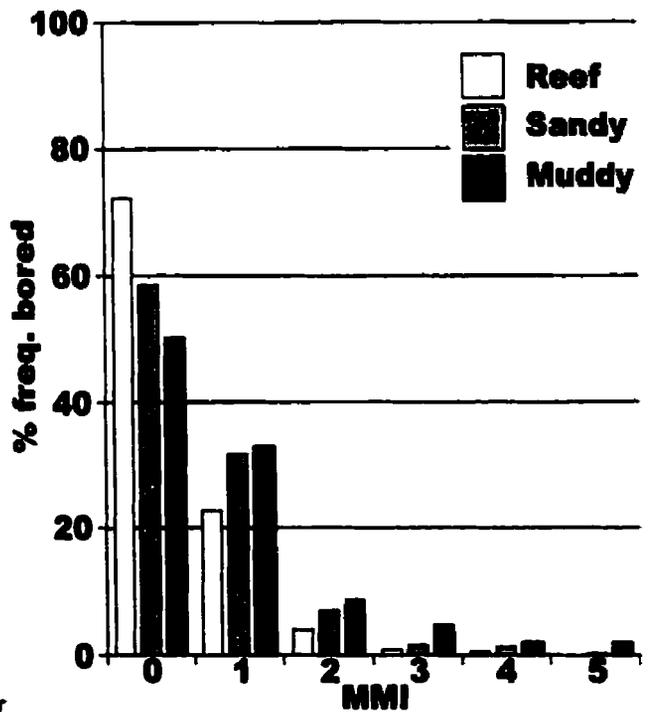
The extent to which organisms can exploit a habitat depends on favourable environmental conditions. Many of the conditions in tropical marine water that presumably favoured corals and stromatoporoids, e.g. warm water temperature, water oxygenation, and normal marine salinity, also favour suspension-feeding macroborers (Edinger and Risk, 1994). Nutrient loading from terrigenous sources (e.g. phosphate enrichment), may favour macroborers more than corals (i.e.



Text-figure 10: Maximum macroboring intensity (MMI) measured for all 2,528 samples. Dashed line shows the percent boring frequency for the total sample set.



Text-figure 11: Boring frequency for all samples from each facies. Error bars = 1 standard deviation.



Text-figure 12: Maximum macroboring intensity (MMI) measured for all samples in each facies.

'Janus effect' of Edinger and Risk, 1994). The following sections will examine conditions likely to enhance bioerosion by extending time of hard substrate exposure and increasing nutrient supply. Temporal changes in macroboring frequency through the stratigraphic column may record the effect of the Late Ordovician mass extinction on bioerosion.

Facies

Coral and stromatoporoid samples were categorized as occurring in one of three facies:

Reef— Dominated by framestone, bafflestone, and bindstone; the reef facies also contains calcarenite and micrite cavity fills. Samples of this facies include skeletons from reef core and flank, but not of inter-reefal material. Deposition of reef material was shallowest among facies, likely in water less than 15 m deep.

Sandy off-reef— Dominated by calcarenite interbedded with minor micrite, this facies may also contain siliciclastic enriched sandstone, especially in Ordovician strata exposed on eastern Anticosti Island. This facies includes inter- and peri-reef material which can be dominated by crinoidal grainstone (e.g. Chicotte Formation). Though not limited by depth, the sandy off-reef facies was generally of intermediate water depth, between 10 m (i.e. inter-reef) and 70 m.

Muddy off-reef— Dominated by calcisiltite, micrite and calcareous mudstone, the micrite facies is characterized by fine-grained carbonate sediments with little to no siliciclastics. Not limited by depth, this facies contains sediments deposited in restricted shallow water settings (e.g. lagoons) or in deep waters (ca. 100 m) below storm-weather wave base.

The observed frequency (Text-figure 11) and intensity (Text-figure 12) of macroborings varies significantly by facies. Samples from the reef are rarely bored (28%), sandy off-reef samples are more frequently bored (41%), and 50% of muddy facies samples are bored. Intensity of bioerosion per sample is also least in reefs, moderate in sands, and highest in the muddy facies. Even in the muddy facies, intensely bored samples ($MMI > 1$) are uncommon, accounting for less than 17% of muddy samples. The observation that boring frequency is least in reef samples, moderate in sandy off-reef samples, and greatest in samples from muddy off-reef facies will henceforth be referred to as the '*facies-trend*'.

The increase in boring frequency described by the facies-trend may be controlled by the different burial rates of corals and stromatoporoids in the three facies, and thus the time the surface of the coral or stromatoporoid substrate was exposed to the watermass. Compared to the sandy facies, the finer sediment size of the muddy facies suggests deposition in waters with lower hydraulic energy, permitting long-term colonization by corals and stromatoporoids. In such a setting, the muddy facies was likely below normal storm-weather wave base or sheltered by a local topographic barrier, but was still influenced by periodic catastrophic storms. Sandy facies also permitted long-term colonization by corals and stromatoporoids, but were likely near or above normal storm-weather wave base and affected more frequently by sediment deposition and reworking by storms. Living tabulates and stromatoporoids were likely able to survive moderate sedimentation by actively shedding sediments (e.g. by faster growth, water pumping, sediment shedding). Since macroborings were dominantly post-mortem, borers could not benefit from the active burial escape mechanisms of the host substrate, only passive mechanisms. For example, host corals or stromatoporoids having a skeleton of high relief, e.g. high domical, would have passively shed sediment better than flatter forms, e.g. low domical (Kershaw, 1984). Wave, current, and storm reworking of seafloor sediments was probably an important passive mechanism for exhuming buried corals and stromatoporoids, re-exposing them to macroborers. While such erosion may have been more common in shallower, unrestricted waters, the more frequent storm-induced deposition of sediment in the sandy facies was apt to bury or overturn corals and stromatoporoids more rapidly than in the muddy facies. This would reduce exposure time of the host substrate in the taphonomically active zone, and ultimately limit bioerosion.

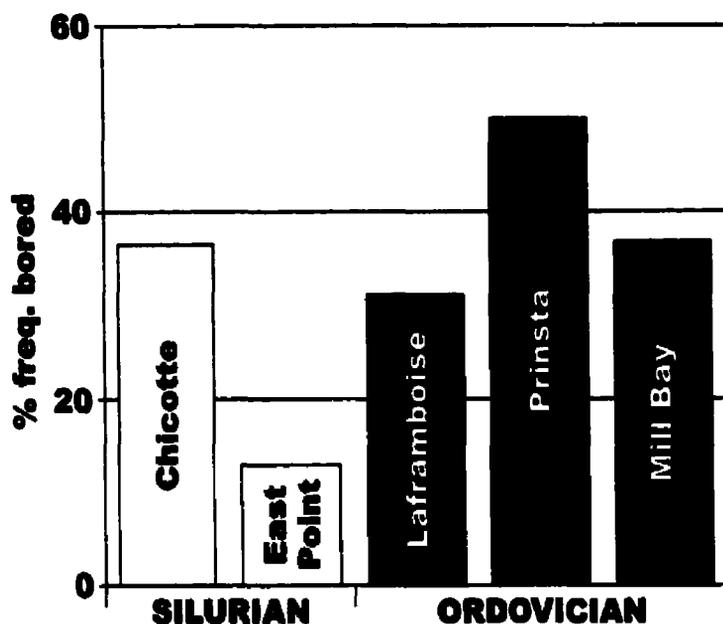
Reef stromatoporoids and corals lived in the shallowest water and would have been greatly influenced by storm activity. Sedimentation rates associated with these storms would have been high, but the longevity of these sediments in the reef facies before being reworked, winnowed, and removed by wave action would have been short (James, 1983). Aside from sedimentation, exposure time of dead coral and stromatoporoid substrates may have been limited by the strong competition for space. Of the three facies, the reef contains the greatest concentration of eligible hard substrates per unit area for macroborers, but occupies less space on the shelf than other

facies. Encrusting organisms including reef-building stromatoporoids and corals, calcimicrobes and myriad epizoans, both skeletonized and non-skeletonized, may have out-competed macroborers in colonizing new hard substrates. Competition on reef macroborers may have marginalized their activity to cryptic cavities or substrates not represented in this study. Variability in boring frequency among reefal units (Text-figure 13) is likely due to differences in the host skeletons comprising each reef.

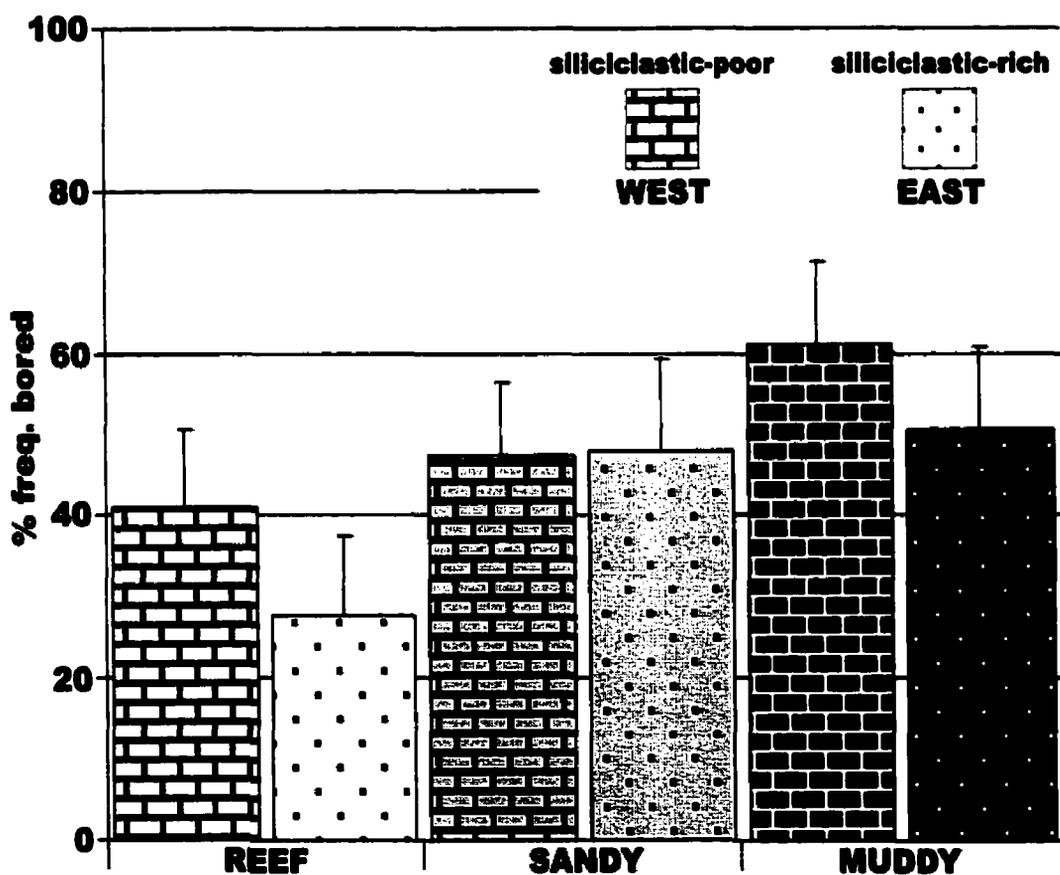
Allochthonous sediment supply

Sand-wave complexes containing a siliciclastic sand component, likely derived from the northern Laurentian coast (Long and Copper, 1987b), formed on the Ordovician carbonate ramp exposed on northeastern Anticosti Island. In addition to enhancing sediment supply, the introduction of allochthonous land-based sediments may have slightly increased nutrient levels on the ramp closest to the sediment source. While vascular plants had not yet evolved, land-based sources of phosphorus (e.g. apatite, D. Long, personal communication, 2001) have been found among heavy minerals comprising <1% of siliciclastic sands from the Ellis Bay Formation (Long and Copper, 1987a). No evidence of enhanced nitrate or dissolved organic matter are preserved in the Anticosti sequence. The effect of terrigenous sediments on bioerosion in the Ordovician was tested by comparing localities from eastern (proximal to siliciclastic source) and western (distal to siliciclastic source) Anticosti Island.

Eastern reef and muddy facies are bored 10% less frequently than from the west (Text-figure 14). No significant difference is observed in sandy off-reef samples. Lower boring frequency in the east suggests a negative effect of terrigenous siliciclastics on bioerosion. The benefits to bioerosion from possible terrigenous nutrient supply was probably outweighed by the abundance of siliciclastic deposits in the east. Increased suspended sediment from siliciclastic silt and clay particles may have also hindered the feeding mechanisms of the bioeroders. Higher sedimentation rate associated with sand-wave complexes in the east would have increased the burial rate of host substrates and reduced their exposure time in the taphonomically active zone.



Text-figure 13: Boring frequency in Ordovician and Silurian reef samples.



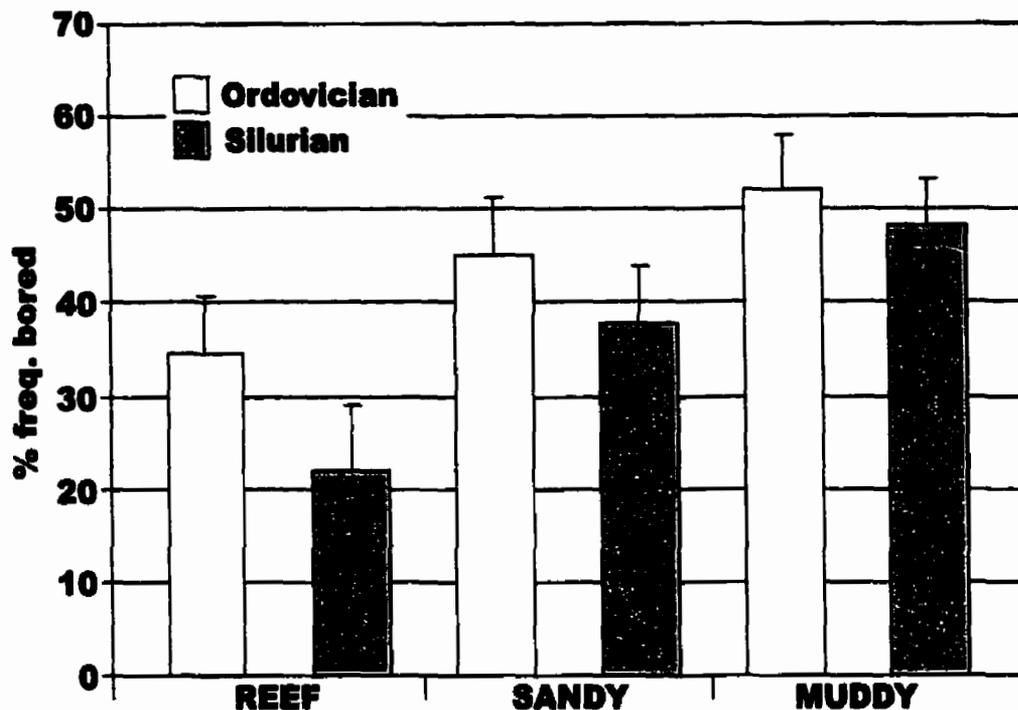
Text-figure 14: Boring frequency of samples from each facies, collected from east and west Ordovician localities. Error bars = 1 standard deviation.

Stratigraphic section & sealevel curve

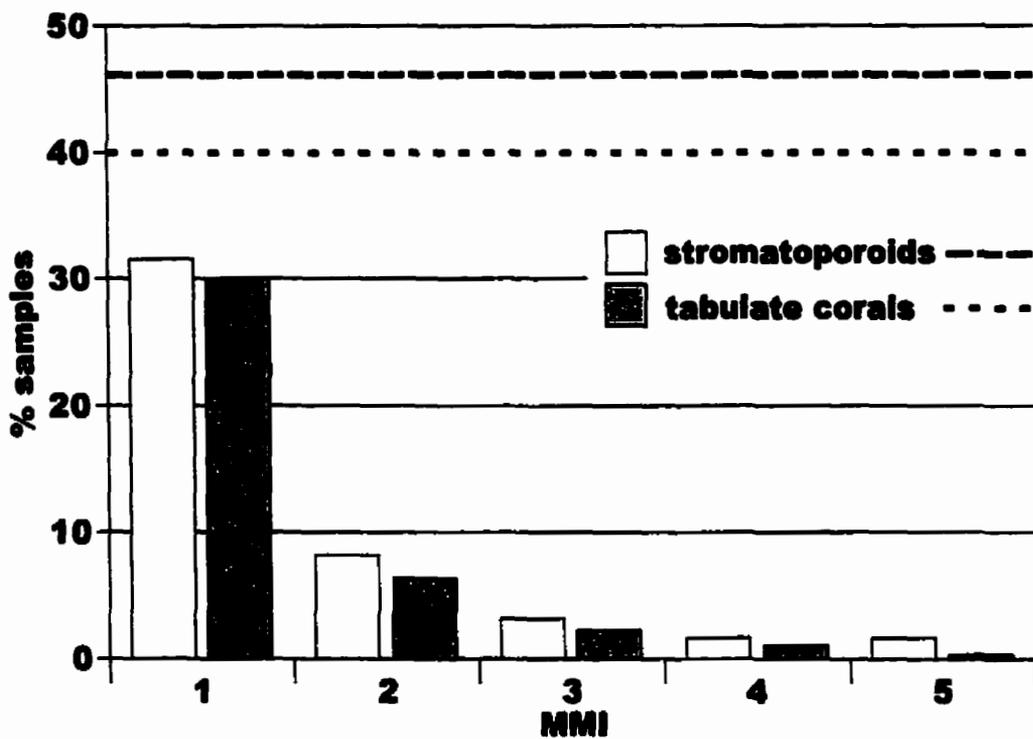
Boring frequency and intensity differs significantly through the stratigraphic column (Text-figure 2), with boring frequencies ranging from less than 15% to over 75%. In large part, the facies-trend accounts for these variations based on the proportion of reef, sandy and muddy facies represented in each member. For example, boring frequency is relatively low (< 25%) in the reef-dominated Laframboise Member. However, the variability in boring frequency among like facies through the sequence must be explained by other external and internal factors. Local changes in sealevel, estimated from sedimentological and paleontologic data (Long, 1993, 1997; Jin and Copper, 1999), are often mirrored by boring frequency. Since facies change with regressive and transgressive episodes, shifting relative sealevel alters boring frequency through the stratigraphic sequence. Transgressive episodes are often accompanied by increased boring frequency and regressions by decreased boring frequency. The Upper Ordovician sequence, for example, shows this relationship well. Deepening facies recorded in the Schmitt Creek and Velleda members are marked by increased boring frequency, while shallowing facies of the upper Mill Bay, Grindstone, Prinsta, and Laframboise members are accompanied by relatively lower boring frequencies. These patterns are strongest with sealevel curves derived from paleontologic data. The response of boring frequency to sealevel is relative: the amplitude of boring frequency is not proportional to sealevel change. Since the resolution of macroboring data is no finer than the member-scale, sealevel changes contained within members are poorly reflected by boring frequency. Additionally, gaps in boring frequency exist for units uninhabited by corals and stromatoporoids, e.g. the deepest water units.

The Late Ordovician mass extinction events

In general, samples from the Ordovician were more frequently bored than those from the Silurian (Text-figure 15). The slight difference among the two periods mostly reflects probable high variability in boring frequency among reefs, and not the effect of mass extinction on borers and their target hosts.



Text-figure 15: Boring frequency in samples from Ordovician and Silurian facies. Error bars = 1 standard deviation.



Text-figure 16: Maximum macroboring intensity (MMI) measured separately for stromatoporoids and tabulate corals. Dashed lines indicate the percent boring frequency for stromatoporoid (long dash) and tabulate coral (short dash) samples.

Episodes of glaciation in the Hirnantian resulted in eustatic sealevel change, cooler sea surface temperatures and altered water chemistry and circulation (Brenchley et al., 1994). Three phases of mass extinction were proposed by Robertson et al. (1991) and Copper (2001): the first at the Rawtheyan-Hirnantian boundary, the second during the Hirnantian, and the third at the Hirnantian-Rhuddanian boundary. Mass extinction events could have adversely affected macroboring in corals and stromatoporoids, (1) directly, by reducing macroborer abundance, or (2) indirectly, by eliminating corals and stromatoporoids preferred by macroborers. Only indirect reduction of boring frequency can be measured in this study, since direct reduction of macroborer abundance can only be detected by analyzing all hard substrates, including hardgrounds, found in the environment. Macroborer reduction may be detected by the loss or decline of macroboring frequency and intensity above an extinction boundary. However, the absence of borers may not necessarily indicate a reduction in boring, as boring may be related to local or regional changes, or biological factors. Similarly, the absence of target hosts may not necessarily indicate a reduction in boring, as the boring activity may have been elsewhere.

The first proposed phase of mass extinction, which appears to be located at the boundary between the Schmitt Creek Member (upper Vauréal Formation) and Grindstone Member (lower Ellis Bay Formation), did not eliminate any stromatoporoid or tabulate species identified in this study (Text-figure 3), though both groups are scarcer in the Schmitt Creek Member than in the unit below. Therefore no effect on boring frequency could be measured. The second proposed extinction phase likely corresponds to the Prinsta-Lousy Cove member boundary. Above this boundary, *Ellisites* and the sarcinulids, *Calapoecia* and *Columnopora*, are no longer found and aulacerids decline significantly. *Ellisites* and the sarcinulids are typically among the most frequently bored corals. However, it is unlikely that their absence in the Lousy Cove Member was responsible for the 10% decline in boring frequency. Rather, this decrease is most likely in response to shifting facies with falling sealevel (Text-figure 2). Embedment structures, such as *Chaetosalpinx rex* n. ichnosp., specific to the sarcinulids, disappear after the Mill Bay Member and cannot be related to the mid-Hirnantian extinction event. The third proposed extinction phase, near the top of the Laframboise member, ushers the end of aulacerids on Anticosti Island. Since

aulacerids are typically among the least frequently bored host substrates (36%), this would have had only a minor effect on bioerosion. Indeed, there appears to be little difference in boring frequency above and below the O/S boundary.

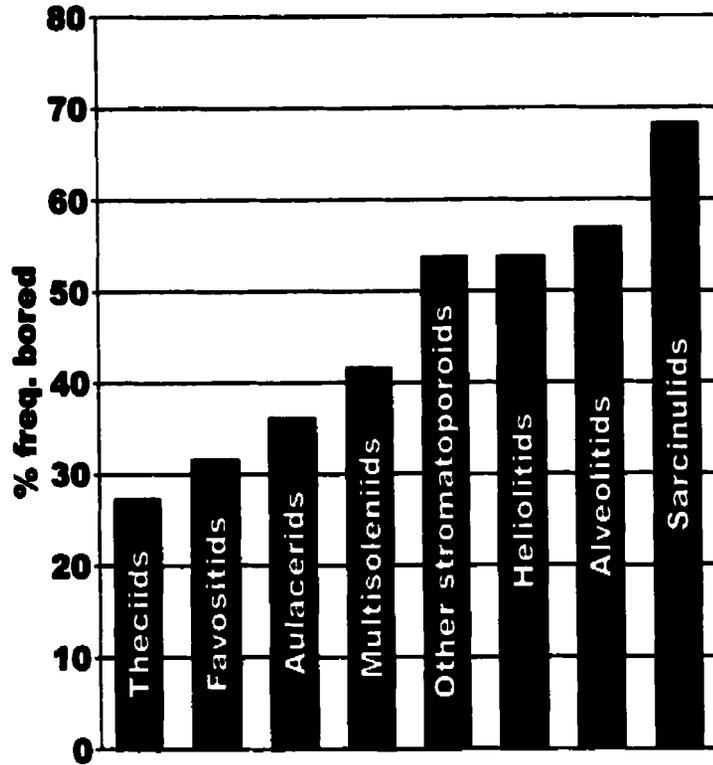
Although *Trypanites* occurred preferentially in some host substrates, they appear to be neither taxon-specific, nor reliant on tabulate nor stromatoporoid hosts. The periodic reduction of habitable area on the carbonate shelf during the Himantian was a major contributor in the extinction of corals and stromatoporoids on Anticosti Island. However, the loss of tabulate and stromatoporoid genera was unlikely to have diminished bioerosion, where alternative hard substrates were present. A testament to the resilience of macroborers is their occurrence in calcimicrobial (*Wetheredella*) crusts preserved near the top of the latest Himantian reefs during peak regression in the Laframboise Member.

Internal variables

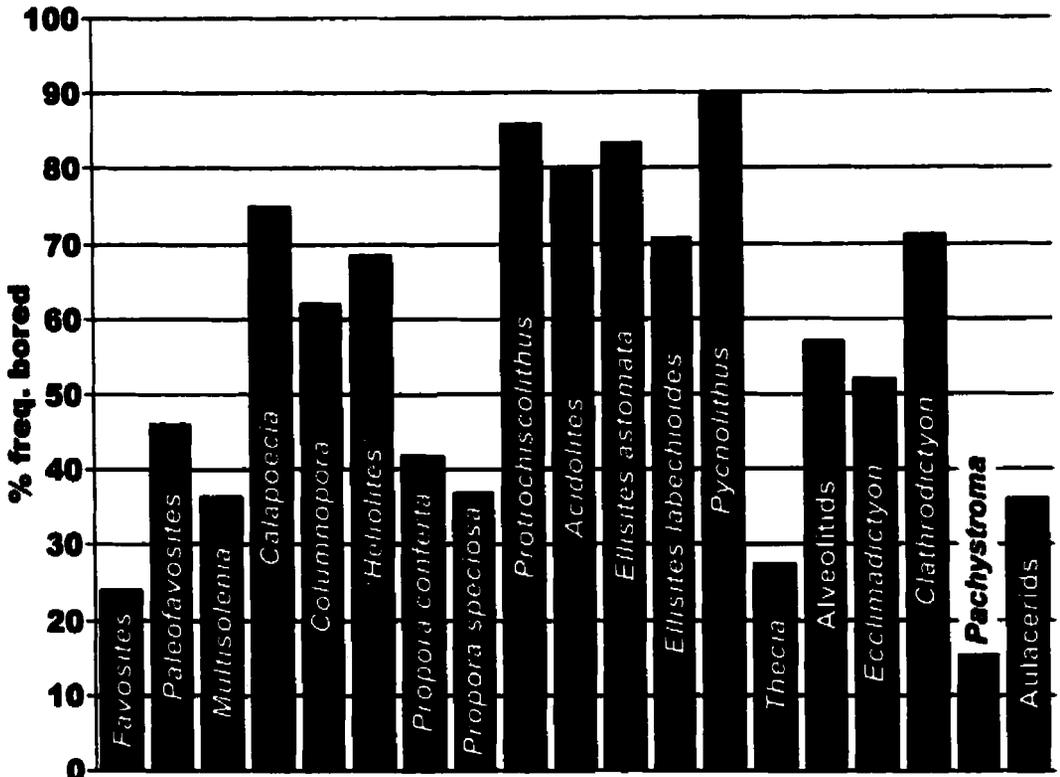
Although *Trypanites* are known from numerous hard substrates, certain characteristics may have made a host substrate more desirable for borers. Substrate taxonomy, shape, and skeletal density were examined for their potential control on bioerosion.

Taxonomy of host skeletons

Although there is only a small difference (6%) in boring frequency favouring stromatoporoids over tabulates (Text-figure 16), groups within these two orders show significant variation (Text-figure 17). Aulacerids are 15% less bored than other stromatoporoids. Both theciids and favositids are below the tabulate average of 40% bored, while sarcinulids are well above average at nearly 70% bored. Variation of boring frequency in genera within groups can also be shown from the data set (Text-figure 18). *Paleofavosites*, representing a third of measured favositids, is 15% more frequently bored than the average for all favositids. Likewise, *Clathrodictyon* accounts for a third of stromatoporoids (excluding aulacerids) and exceeds the group average by over 15%. Although only representing 2% of stromatoporoids, *Pachystroma* is nearly 40% less frequently bored than the group average. Minor representatives of the heliolitid group,



Text-figure 17: Boring frequency measured for taxonomic families of host stromatoporoid and tabulate coral samples.



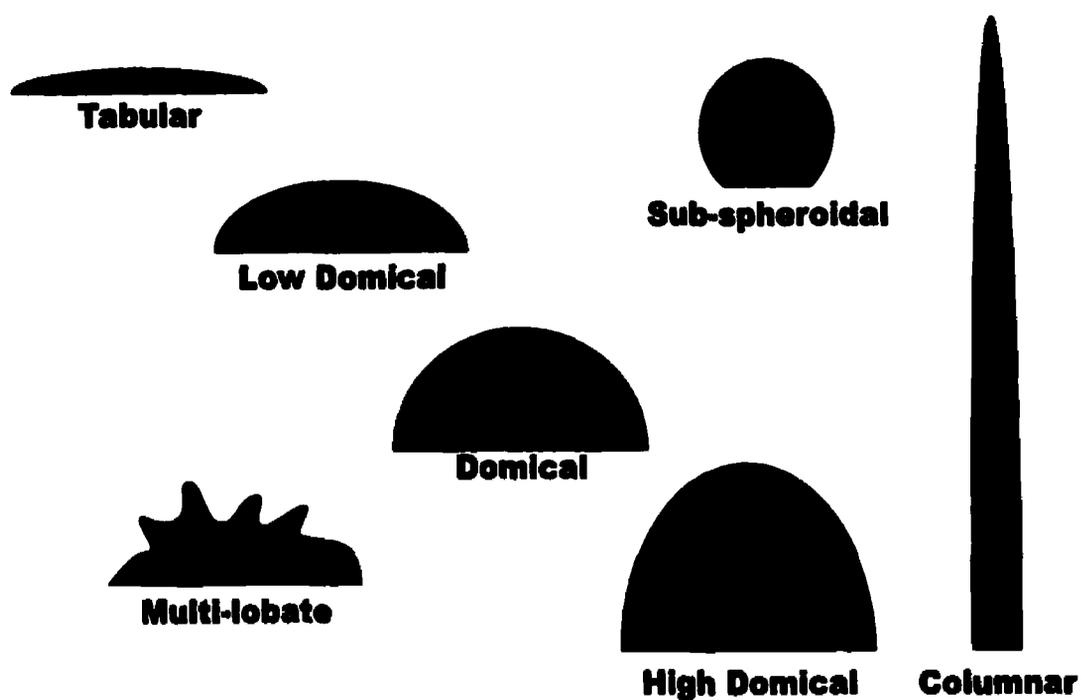
Text-figure 18: Boring frequency measured for host stromatoporoid and tabulate coral genera. Aulacerid and alveolitid families included; two species of *Propora* and *Ellisites* recognized.

Protochiscolithus, *Pycnolithus*, *Ellisites*, and *Acidolites* are very frequently bored (up to 90%), compared to the common *Propora conferta* which is 10% below the heliolitid average. Clearly, variability exists at all taxonomic levels, including conspecifics: *Ellisites labechioides* is 10% less frequently bored than *E. astomata*. Though not formally measured, massive rugose corals (*Palaearaea* and *Arachnophyllum*) from the collection were examined for the presence of macroborings. Several dozen samples showed no clear evidence of macroboring. The variability among and within related taxa suggests that, in most cases, host substrate taxonomy had little effect on bioerosion. Notable exceptions include embedment structures which were formed in a living substrate (e.g. *Chaetosalpinx* ichnosp., *C. rex* n. ichnosp., and *Klemmatoica linguliforma* n. ichnogen. & ichnosp.). Since the majority of borings occurred post-mortem, attributes of the host substrate related to living tissues, chemical repellants, stinging cells, etc. were unlikely limiting agents to bioerosion, and would have had little effect on overall boring frequency and intensity. Instead, the physical properties of the host substrate were more important (e.g. shape and skeletal density).

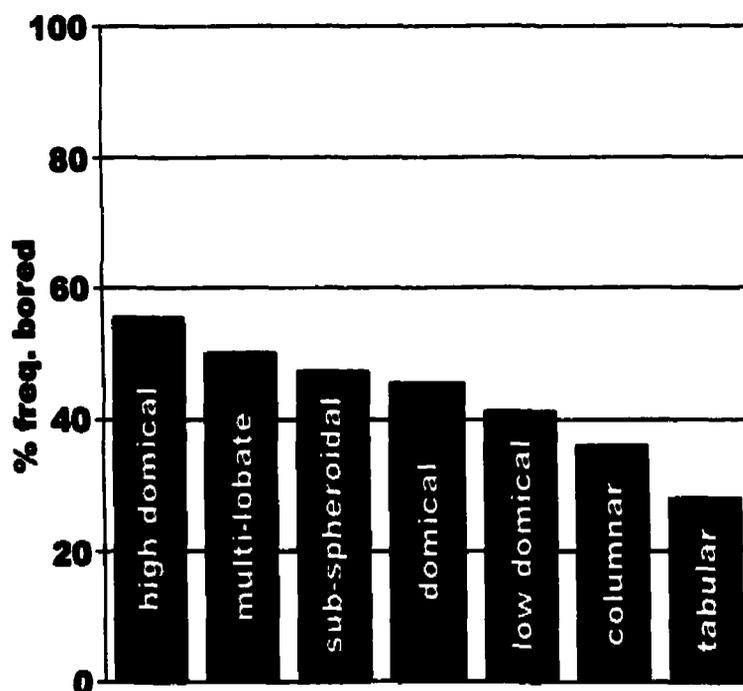
Shape of host skeletons

The shape of corals and stromatoporoids is influenced by phylogenetic (taxonomic) and ecologic factors. The samples were categorized under seven skeletal shapes: tabular, low domical, domical, high domical, multi-lobate, sub-spherical, and columnar (Text-figure 19).

A nearly 30% difference exists between the most frequently bored high domical samples and the least, tabular samples (Text-figure 20). The low (28%) boring frequency in tabular samples may not be solely attributed to generic and facies controls. Tabular samples are significantly represented by frequently bored genera (e.g. *Paleofavosites*, *Clathrodictyon*, and alveolitids) and these were most heavily sampled from the commonly bored sandy facies. This suggests that tabular shape was significant in limiting bioerosion, possibly because the host substrate was more susceptible to burial. Increased relief of substrate form appears to result in increased boring frequency. However, for very high relief forms, i.e. columnar aulacerids, macroborings are 20% less frequent than high domical samples. This disparity can be explained by the post-mortem



Text-figure 19: General illustration of host sample shapes recognized in this study. Not to scale.



Text-figure 20: Boring frequency measured for each host shape.

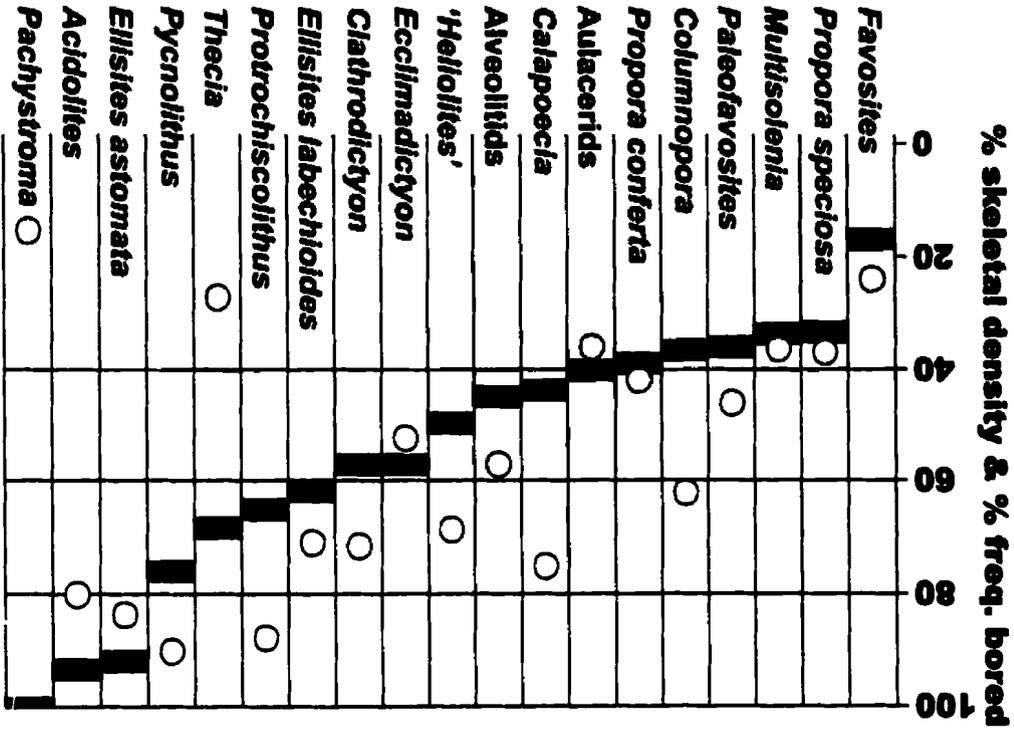
nature of bioerosion and the taphonomy of aulacerids (Text-figure 5). While alive, aulacerids grew upright forming tall columns, but were not bored. Periodic storms would decapitate the aulacerids (Cameron and Copper, 1994), leaving the toppled columns on the seafloor and available to encrusters and borers, which are usually found on only one side of the column. As such, aulacerids are best considered domical in their presentation to the bioeroding community. Compared to other domical samples, the aulacerids are 10% less frequently bored, which suggests that other factors, such as small diameter size, low skeletal density and burial resulting from toppling, may have been important in limiting bioerosion. The observation that boring frequency increases with increased host substrate relief will henceforth be referred to as the '*shape-trend*'.

Host skeletal density

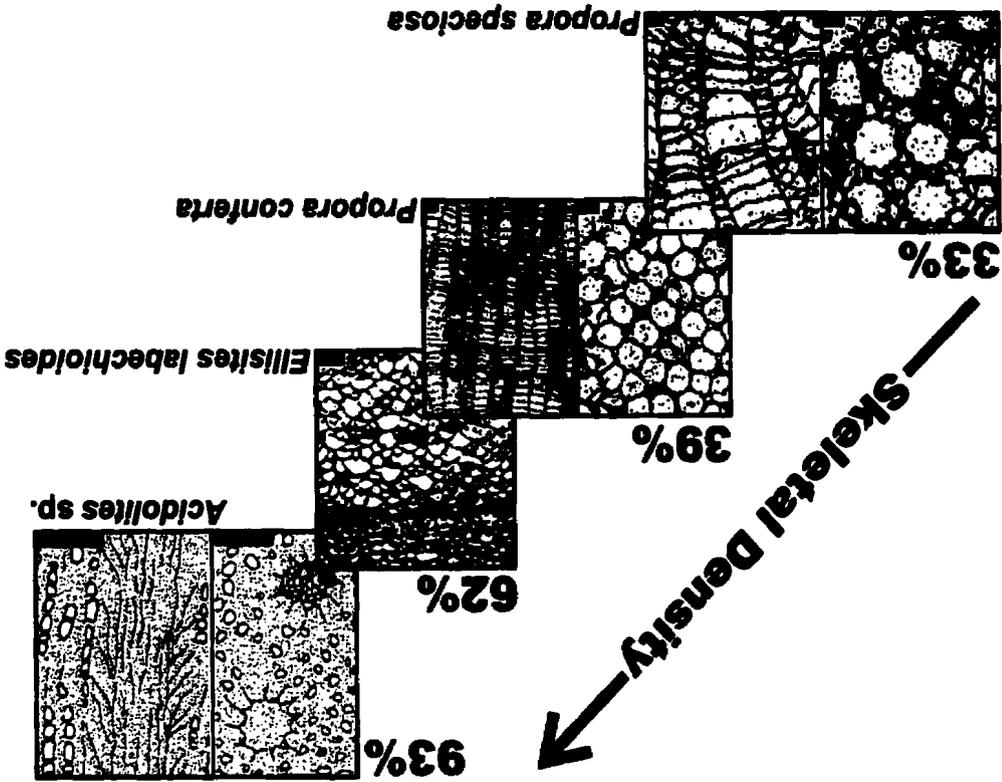
Skeletal density (SD) is the percentage of skeletal parts (e.g. pillars, laminae, tabulae, cysts, septa) relative to cavities (e.g. galleries, calices) in a substrate (Text-figure 21). The greater the skeletal density of the substrate, the more energy required for excavation, but also the more stable and protected the nature of the boring.

In general, skeletal density is positively correlated with boring intensity and frequency (Text-figure 22; Table 3). Over 80% of dense skeleton *Pycnolithus* and *Acidolites* are bored, while less than 30% of the highly porous *Favosites* are bored. There are a number of genera which do not follow this trend. *Columnopora* and *Calapoecia* appear to be bored more frequently than genera of similar skeletal density. Abnormal *in vivo* embedment structures (i.e. *Chaetosalpinx rex* n. ichnosp. in *Columnopora*) are likely more influenced by host substrate taxonomy than skeletal density. *Thecia* and *Pachystroma* are infrequently bored relative to their high skeletal densities. Since these are most commonly found in reef settings (where boring frequency tends to be low), with few sandy and no muddy off-reef occurrences, it is likely that facies played a greater role than skeletal density in influencing boring frequency. Similarly, the absence of borings in the colonial rugosans *Arachnophyllum* and *Palaeareaea* may be due to their frequent occurrence in the poorly-bored reefal setting, rather than to their taxonomic affinity or skeletal properties. The

Text-figure 22: Percent skeletal density (black dash) and boring frequency (circle) measured for select host taxonomic families, genera, and species.



Text-figure 21: Percent skeletal density given for select host substrates. Transverse (left) and longitudinal (right) thin sections shown for three host taxa; only longitudinal section shown for *Ellisites labechloides*. All scale bars = 1 mm. Images c.f. Dixon (1974, 1986); Dixon et al. (1986).



observation that boring frequency increases with increasing host skeletal density will henceforth be referred to as the '*SD-trend*' (skeletal density-trend).

Comparative influence of internal and external variables on bioerosion

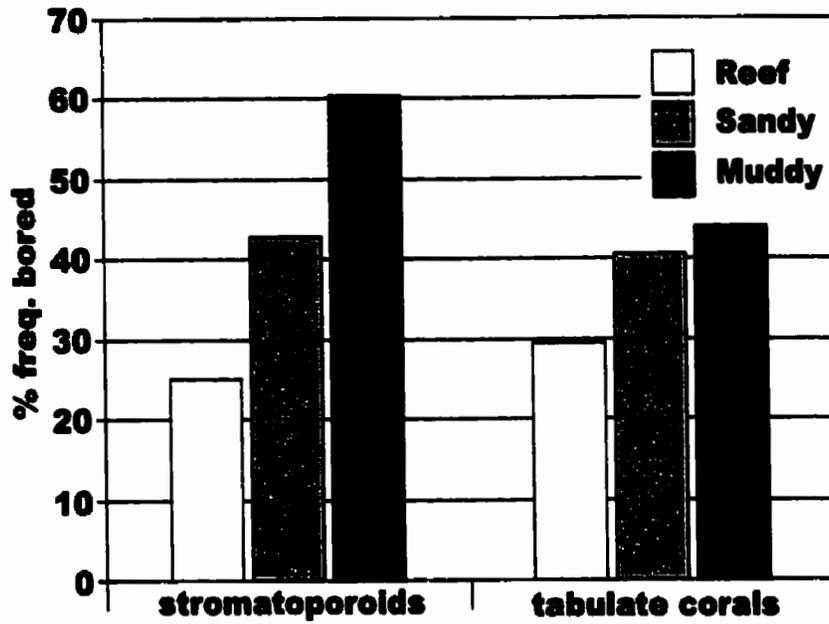
In the following section, boring frequency is compared between samples segregated by internal (host taxonomy, shape, and skeletal density) and external (facies) variables described in the previous section.

Taxonomic Order by Facies

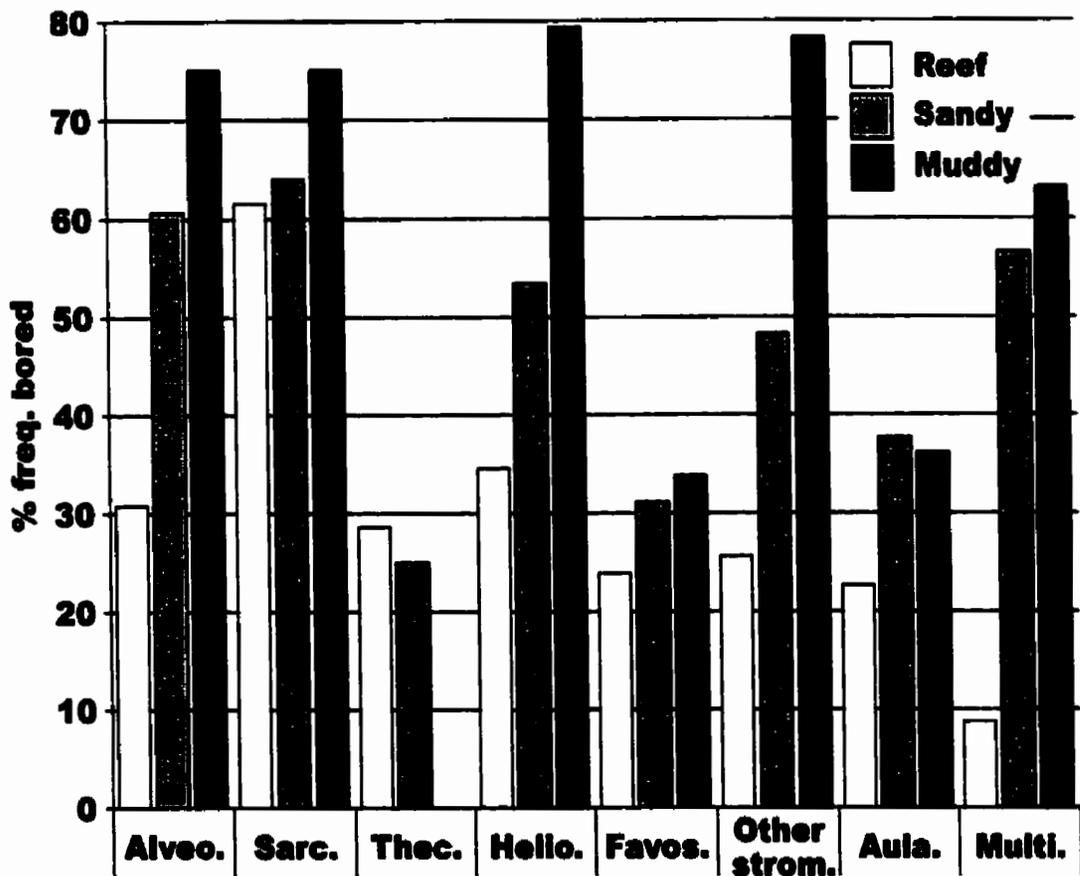
Both taxonomic order-level and facies-level trends are present, but the facies-trend is most significant (Text-figure 23). Although stromatoporoids show higher boring frequency, especially in muddy facies, the average boring frequencies between tabulate corals and stromatoporoids only differ by 5%. More apparent is the facies-trend, where in both orders, samples from the reef are bored less often than from the sandy facies, which are bored less than the muddy facies. Between orders, the facies-trend appears strongest among stromatoporoids. In this comparison, it is concluded that the facies from which the sample was collected is more significant to boring frequency than the taxonomic order (tabulate or stromatoporoid) to which the host substrate belongs.

Taxonomic Family by Facies

Interfamilial variation in boring frequency is significant, but so too is the facies-trend. All families sampled repeatedly from all facies ($n > 4$) showed the facies-trend (Text-figure 24). In all families, except theciids, reefs are the least bored as predicted by the facies-trend. Although variation generally occurs at the family level, analysis of different families from the same facies (e.g. reef) show similar boring frequencies. Sarcinulids are a notable exception, with a high boring frequency of reef samples, however, sarcinulids from muddy facies are bored more frequently than from the reef. Since the facies-trend can be clearly observed in nearly all families, it is concluded that facies are more significant than taxonomic family.



Text-figure 23: Boring frequency measured for host stromatoporoids and tabulate corals from each facies.



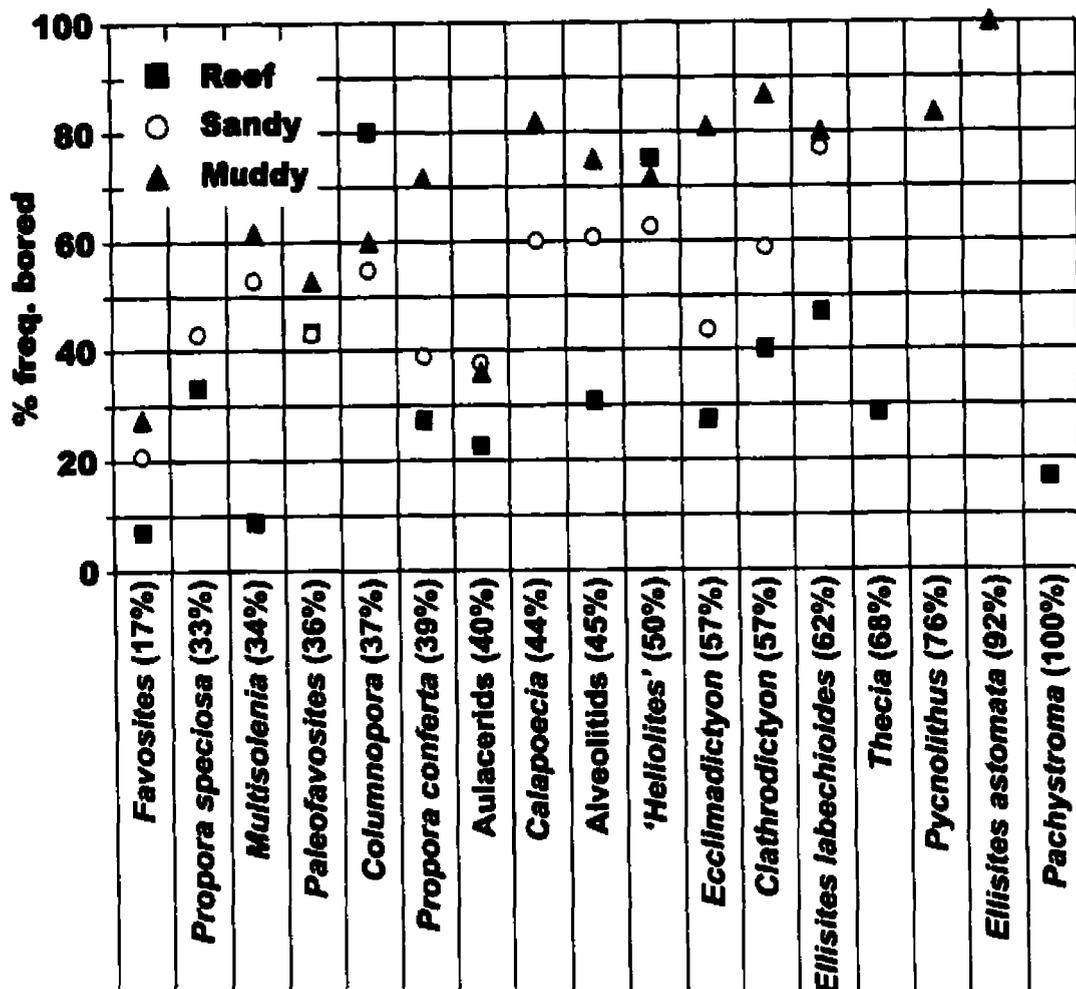
Text-figure 24: Boring frequency measured for host taxonomic families from each facies. Alveo. = alveolitids, Sarc. = sarcinulids, Thec. = thecids, Helio. = heliolitids, Favos. = favositids, Other strom. = non-aulacerid stromatoporoids, Aula. = aulacerids, Multi. = multisoleniids.

Genus by Facies

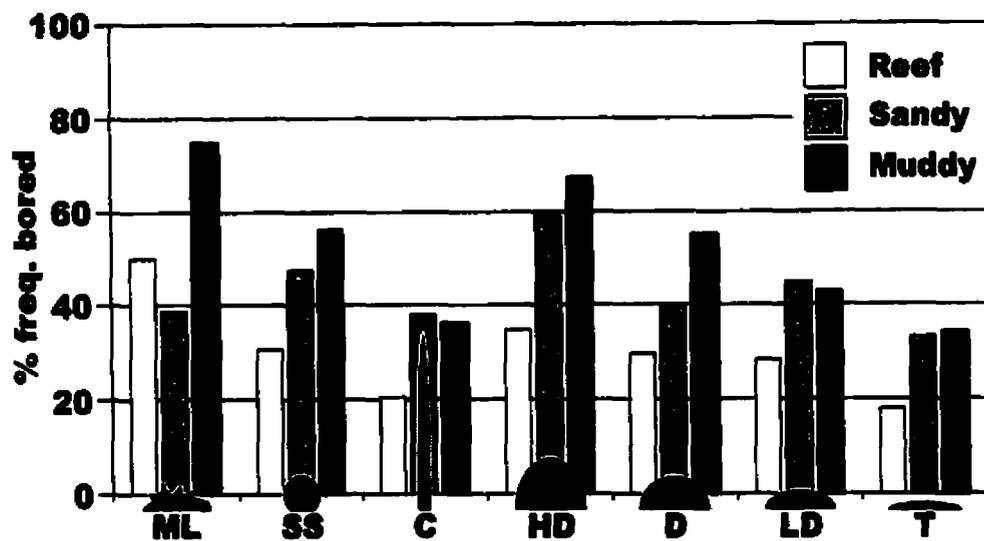
Boring frequency varies at the genus level as significantly as it does by facies. In general, the facies-trend among genera is marked (Text-figure 25): reefal samples are bored less frequently than other facies. *Columnopora* and '*Heliolites*' are notable exceptions. More striking is the variability in boring frequency among genera sampled from reefs. The average boring frequency for reefs is low (28% from Text-figure 12), yet among genera sampled from reefs, boring frequency can be as high as those found in other facies. For example, reefal *Paleofavosites*, *Ellisites labechioides*, and *Clathrodictyon* are bored as frequently as most sandy off-reef samples. Among these three groups, the increased boring frequency observed in the reef also occurs in the other facies, such that the facies-trend is satisfied. For all facies, intergeneric variation in boring frequency is significant. It is concluded that, although the facies-trend is strong, it is not as significant in affecting boring frequency as generic variation.

Skeletal Density by Facies

Both skeletal density and facies are significant variables in boring frequency. Since each genus can be defined as a substrate by its skeletal density, variation in boring frequency is equivalent at both generic and skeletal density levels (Text-figure 25). Defining genera by skeletal density converts data from categorical to numerical, which can then be tested by simple linear regression, where skeletal density is the independent variable X and boring frequency is the dependent variable Y (Table 3). For all facies combined, skeletal density is weakly positively correlated with boring frequency. However, the significance of skeletal density varied greatly between facies. Variation in boring frequency attributable to skeletal density was negligible in reefs and moderate in sandy and muddy facies. The low r -squared value for reef samples is in part due to the high boring frequency in *Columnopora* and to *Pachystroma* which has nearly 100% skeletal density, but is seldom bored. The facies-trend appears to dominate skeletal density in the reef, but skeletal density is more influential on boring frequency in sandy and muddy facies.



Text-figure 25: Boring frequency measured for select host taxonomic families, genera, and species from each facies. Data points calculated from sample sizes of 5 or greater. Percent skeletal density follow taxa in brackets.



Text-figure 26: Boring frequency measured for each host shape from each facies. ML = multi-lobate, SS = sub-spheroidal, C = columnar, HD = high domical, D = domical, LD = low domical, T = tabular.

Facies	Reef	Sandy	Muddy	Sandy & Muddy	All Facies
r-squared	0.00	0.56	0.68	0.73	0.12
P-value	0.9	0.003	0.0003	0.0002	0.15

Table 3: The dependence of boring frequency on skeletal density, separated by facies.

Shape by Facies

Both the shape-trend and the facies-trend influence boring frequency (Text-figure 26). High domical samples from all facies had higher boring frequencies than tabular samples from any facies: domical and low domical samples fell between these two morphologies. For all shapes, except multi-lobate, reef samples were the least bored of the facies. Since all but one growth form show the facies-trend, it is concluded that facies is more significant than host substrate shape in influencing boring frequency.

Shape by Genus and Skeletal Density

The shape-trend is strong in both rarely and commonly bored genera, such as *Favosites* and *Clathrodictyon*, respectively. In both *Favosites* and *Clathrodictyon*, tabular samples were bored roughly 30% less often than samples which were high domical. However, among tabular samples, *Favosites* was bored 45% less than *Clathrodictyon*. Even greater disparity in boring frequency is observed among high domical *Favosites* and *Clathrodictyon*. Although shape appears to have an effect on boring frequency, generic variation appears to be more significant. Since generic variation is quantified by skeletal density, it would follow that skeletal density influences boring frequency more than does shape. Tabular samples show a slight increased boring frequency with increased skeletal density. Notable exceptions, such as *Propora conferta* (SD = 39%) and *Thecia* (SD = 68.2%), show much lower boring frequency than do samples of lower skeletal density. The other substrate shapes, however, do show the SD-trend with more consistency. Aside from the sarcinulids (SD = 36.5%, 43.8%), domical samples show a strong SD-trend.

Comparison using five well represented host taxa

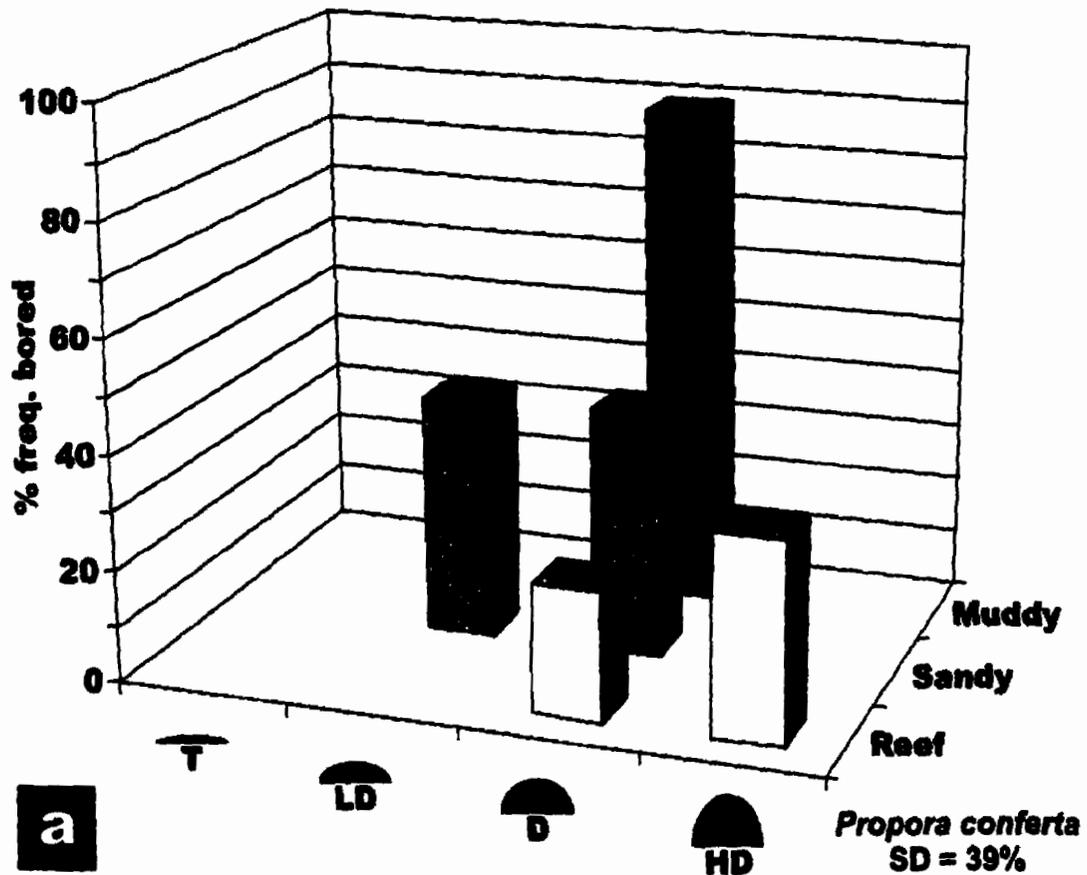
To help elucidate the comparative significance of host substrate genus, shape, skeletal density, and facies on boring frequency, a comparison of five well represented host taxa (sample size, $n > 170$) were selected from the total data set. Two favositids (*Favosites* and *Paleofavosites*), two stromatoporoids (*Clathrodictyon* and *Ecclimadictyon*), and the heliolitid *Propora conferta* were categorized by facies and shape. Where $n > 9$, the percentage frequency bored was calculated (Text-figure 27) and observations are summarize in Table 4.

Host substrate	%SD	Facies-trend	Shape-trend	Total % freq. bored
<i>Ecclimadictyon</i>	57	LD, D, HD	S	52
<i>Clathrodictyon</i>	57	LD, D		71
<i>Favosites</i>	17	D	R, M	24
<i>Paleofavosites</i>	36	D, LD	S, M	46
<i>Propora conferta</i>	39	D	R	42

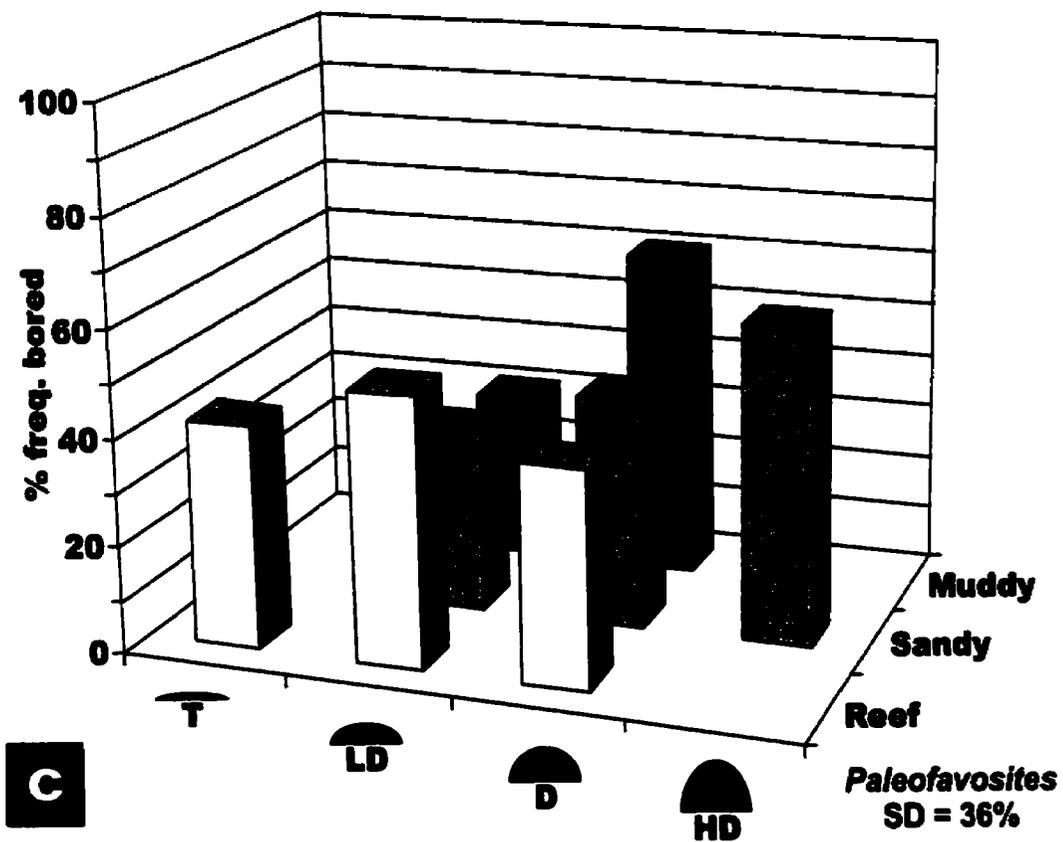
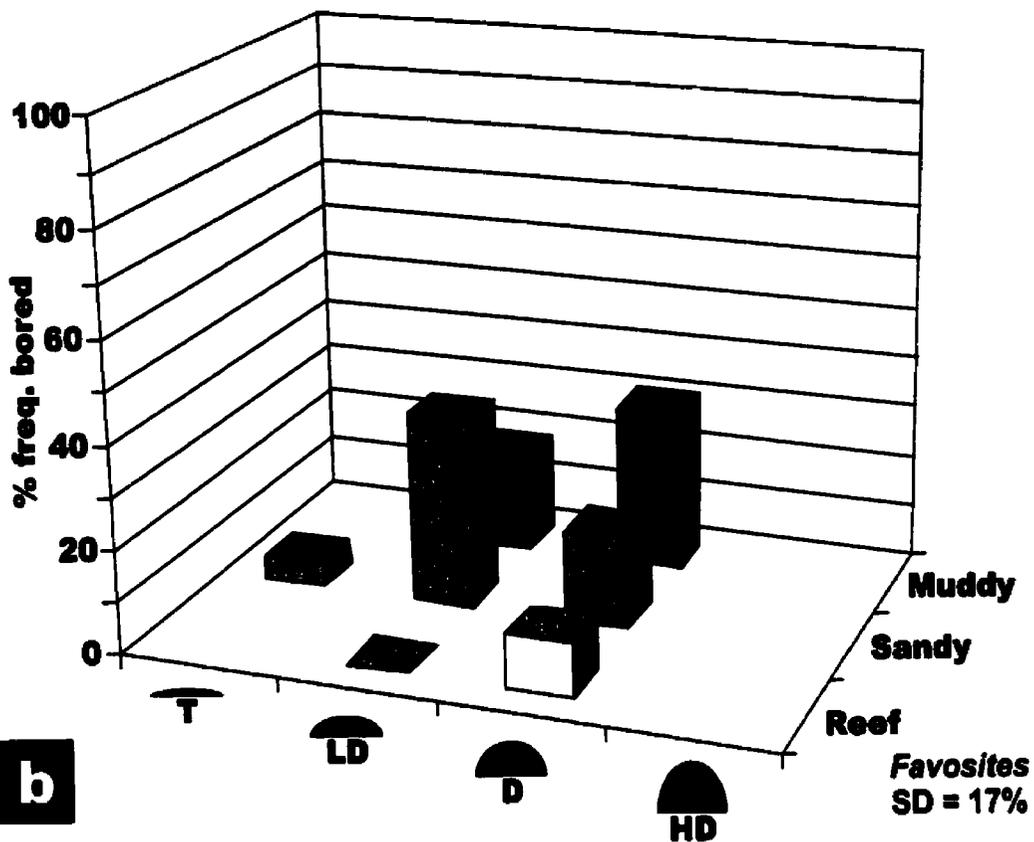
Table 4: Summary of observations made from Text-figure 27. Facies, shape, and skeletal density are compared for 5 host substrate taxa. Occurrence of facies-trend (boring frequency: reef < sandy < muddy facies) among host shapes denoted by typeface: bold = strong facies-trend; normal = slight facies-trend; strikethrough = reverse facies-trend. Occurrence of shape-trend (boring frequency: tabular < low domical < domical < high domical shape) among facies denoted by typeface: bold = strong shape-trend; normal = slight shape-trend. In general, boring frequency correlates positively with percent skeletal density (%SD). D = domical; HD = high domical; LD = low domical; R = reef facies; S = sandy off-reef facies; M = muddy off-reef facies.

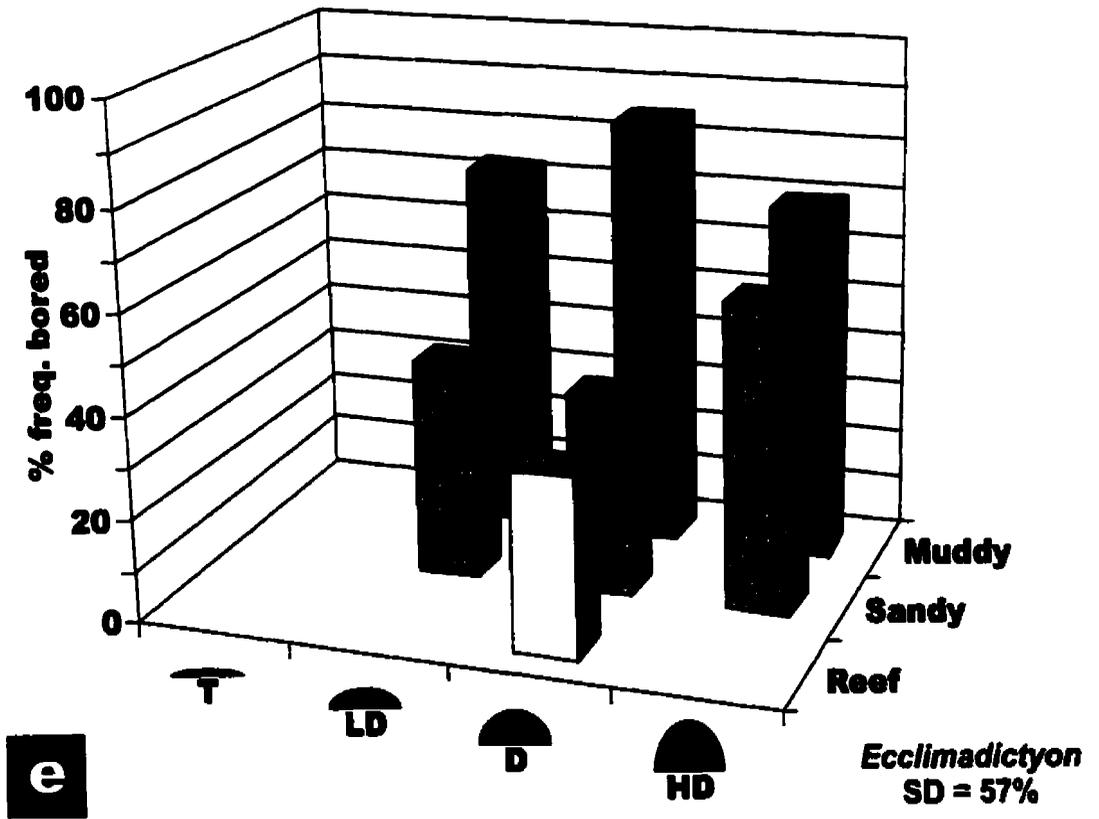
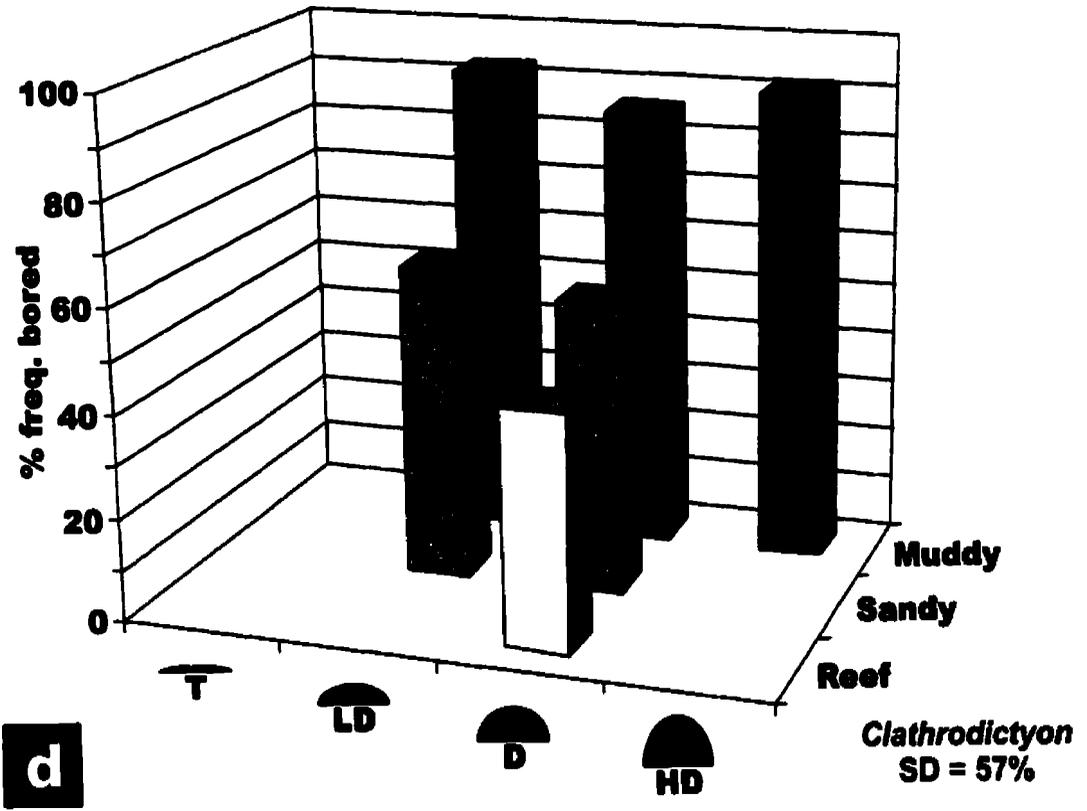
From these observations, the facies-trend appears to be strong in all five host taxa, especially in low domical and domical samples. The shape-trend is generally less distinct than the facies-trend, except in *Paleofavosites*. By comparing equivalent shapes and facies between the five taxa, the SD-trend is generally positive. Further, the skeletal density also correlates well with the total frequency bored values for each taxon.

A comparison of the two favositids shows that, for nearly all combinations of shape and facies, *Favosites* is bored less frequently than *Paleofavosites*. Although collections of *Favosites* were all from the Silurian, in contrast to only a third of collected *Paleofavosites*, the different temporal



Text-figure 27: Boring frequency measured for taxa of different shapes and from each facies. Taxa include the heliolitid (a) *Propora conferta*; favositids (b) *Favosites* and (c) *Palaefavosites*; and stromatoporoids (d) *Clathrodictyon* and (e) *Ecclimadictyon*. Only boring frequencies calculated from 10 or more samples are shown. SD = host skeletal density; Host shapes: T = tabular, LD = low domical, D = domical, HD = high domical.





ranges of these favositids is not likely to have affected boring frequency since little difference has been observed in the frequency of boring among other Ordovician and Silurian taxa. Rather, structural differences such as corallite diameter and skeletal density are likely contributors.

Favosites, having a generally larger corallite diameter and lower skeletal density than *Paleofavosites* was likely a less suitable substrate for most macroborers.

Genus-level variation is best observed between the two equally dense stromatoporoids, *Clathrodictyon* and *Ecclimadictyon*, where the former is bored slightly more frequently than the latter. Though minor, such variations cannot be accounted for by shape, facies, or skeletal density, and since the borings are predominantly post-mortem, cannot be explained by their biological (i.e. generic) differences. The dominant occurrence of *Clathrodictyon* in the frequently and intensely bored muddy facies of the Goéland Member is likely the cause of the observed variation. Had *Ecclimadictyon* been more abundant in the Goéland muds, boring frequency between it and *Clathrodictyon* would likely have been more similar.

Controls on macrobioerosion

The rate of host substrate burial appears to have been the primary external control on macroboring frequency. Since macroborers require continuous intervals of non-deposition (Bromley and Asgaard, 1993), storm-dominated sedimentation may have controlled bioerosion by limiting the residence time of eligible hard substrates in the taphonomically active zone. Burial rate was influenced by the shape and behaviour of the host substrate, the rate of sediment supply, frequency of storms, and the activity of infauna and epibenthos in resuspending fine sediment.

The division of the off-reef facies by sediment size (sandy and muddy) is useful in characterizing the frequency of storm-related burial of host substrates. Greater depositional water depth below average storm wave base and/or localized zones of restricted water flow are generally suggested by the finer sediment size of the muddy off-reef facies. While thicker blankets of sediment would be expected for the muddy facies, only rare, severe storms would leave an appreciable deposit (Miller et al., 1988), and may have subsequently been winnowed.

Sandy off-reef facies, by contrast, were more frequently subjected to storm deposition, resulting in a higher rate of coral and stromatoporoid burial. Reefs, formed above fair weather wave base, were frequently exposed to storm reworking and deposition. However, the high hydraulic energy on the reef generally limits storm deposition to reef cavities and flanking beds, or to the overturning of coral and stromatoporoid framework, creating *in situ* conglomerates or breccias. Dead reef corals and stromatoporoids are commonly encrusted by organisms rather than sediments. The competition for space on a reef is very high (Jackson, 1977) and rapid encrustation, by skeletal and non-skeletal organisms, may have limited bioerosion (Perry, 1996).

The facies-trend observed in this study suggests that hard substrate burial by biological encrustation on reefs exceeded burial by sediment off-reef. Further, net sediment burial rates in the sandy facies was more rapid than in the muddy facies. Decreased bioerosion in the Late Ordovician proximal to the siliciclastic source, despite a possible increase in terrigenous nutrient supply, suggests that enhanced sedimentation limited bioerosion due to the burial of corals and stromatoporoids. Aside from differences in sedimentation, other facies-related factors directly affecting bioerosion may include, water depth, hydraulic energy, and proximity to shore. Although Kobluk and Kozelj (1985) found no relationship between bioerosion and depth in a modern reef core, many authors (Bromley, 1978; Rice and MacIntyre, 1982; Pandolfi and Greenstein, 1997) have suggested both water agitation and depth to be significant controls on modern bioerosion. An off-shore decline in bioerosion linked to decreased nutrient supply has been noted in the modern Great Barrier Reef (Risk et al., 1995; Edinger and Risk, 1997) and Discovery Bay, Jamaica (Perry, 1998), and the Upper Miocene reefs of Mallorca, Spain (Perry, 1996). These results, however, were based entirely on reefal corals: while total bioerosion decreased off-shore, worm borings were found to increase off-shore (Risk et al., 1995) and in muddy lagoons (Perry, 1996).

Although not quantified in this study, branched corals and stromatoporoids from Anticosti Island were very rarely bored compared to massive forms. Pandolfi and Greenstein (1997) have similarly recognized the preference of boring worms for massive corals. Massive hosts may be preferred for their greater depth accommodation space for macroborers (Pleydell and Jones,

1988; Perry, 1996) and a robust form is less prone to breakage and burial. Skeletons of lower relief are predisposed to more rapid passive burial than high domical forms (Kershaw, 1984). However, tabular forms typical of very high energy wave and current swept reef tops would likely be continuously cleaned of sediment by water movement. This may also deter the settlement of borer larvae. Thus, bioerosion generally occurs most often in high relief forms and borings are concentrated on topographical highs (Nield, 1984; Segars and Liddell, 1988; Lebold, 2000). In addition, shapes which provide optimal water currents, while reducing sediment accumulation, influence the distribution of suspension feeding macroborers (Kobluk and Nemcsok, 1982; Nield, 1984).

Although shape was an important factor affecting rate of burial, skeletal density of the host substrate was the most significant internal variable. Highsmith (1981) first proposed a positive relationship between bioerosion and skeletal density by observing bivalve borings in modern corals (i.e. denser skeletons have more borings). The relationship has since been supported by Pandolfi and Greenstein (1997) and Perry (1996), but rejected by Edinger and Risk (1997). The findings of the current study are the first to detect a positive correlation between bioerosion and skeletal density for Paleozoic substrates. As suggested by Highsmith (1981), the value of a safer domichnia offsets the extra energy required to bore into a denser substrate. Further, a dense substrate was a more adaptable medium in which to excavate an unlined boring, such as *Trypanites*. Though less frequently bored, corals of low skeletal density (e.g. *Favosites*) were not always 'resistant to attack' by macroborers, as argued by Newall (1970) for favositids from the Upper Silurian of the Welsh Borderlands. Despite its correlation with skeletal density, the dominant influence of facies on bioerosion is best observed in the infrequently bored, yet highly dense, Silurian reefal stromatoporoid, *Pachystroma*. Risk and Sammarco (1991) have shown that modern scleractinian skeletal density increases significantly offshore in response to either decreased nutrient supply or increased light penetration offshore. Such an offshore increase in skeletal density was not observed in the Anticosti material.

In studying the Oligocene-Miocene mass extinction, which eliminated nearly half the Caribbean hermatypic corals species, Edinger and Risk (1997) found that bioeroders were virtually

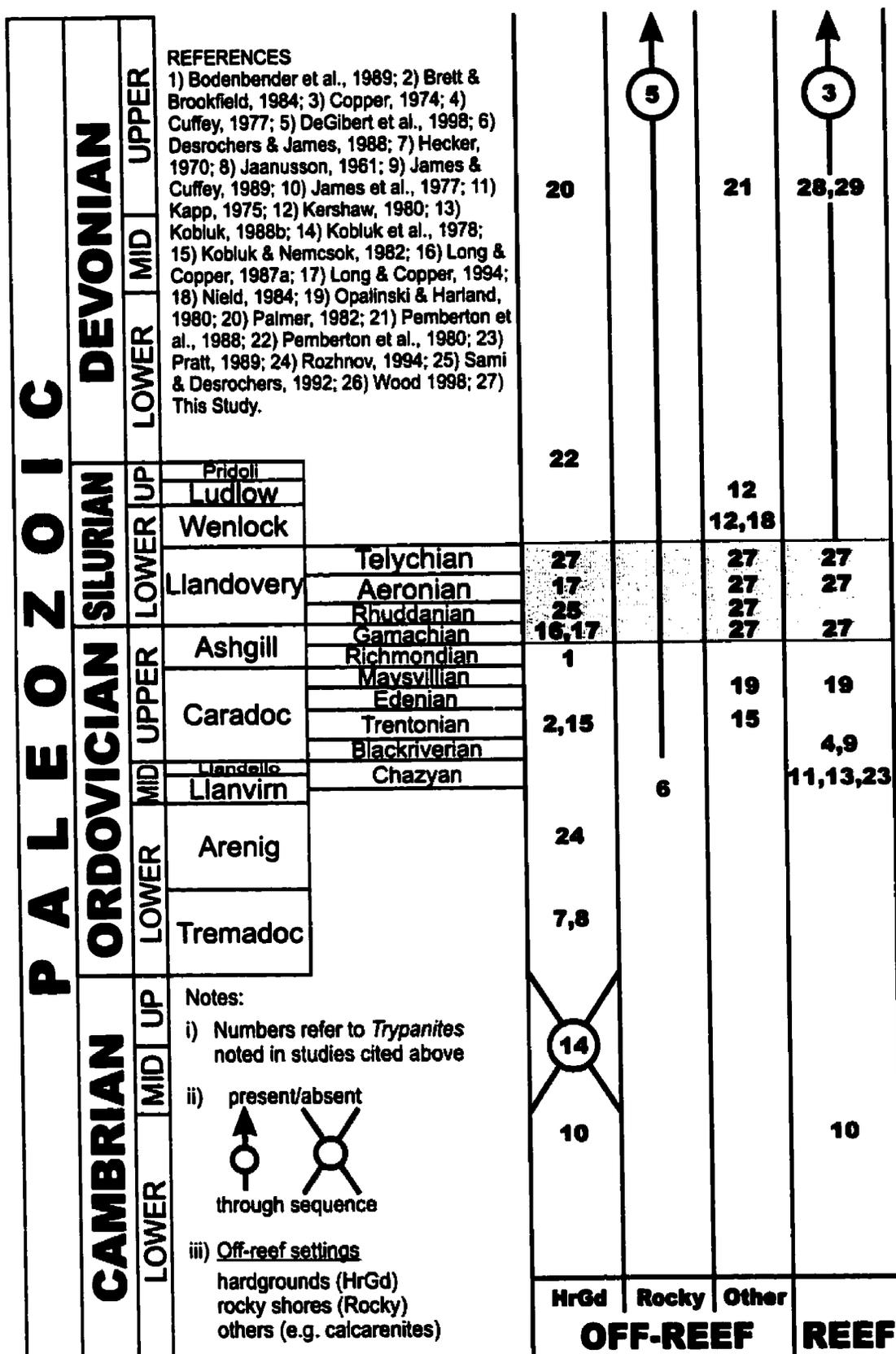
unaffected. Similarly, the Late Ordovician mass extinction events had little influence on boring frequency, despite the loss of ellisitids, sarcinulids and aulacerids. Since opportunistic borers are generally more eurytopic (i.e. euryhaline, eurythermal, euryphotic) than their skeletal host substrates (Edinger and Risk, 1997) and may inhabit abiotic substrates (e.g. hardgrounds and pebbles), environmental catastrophes detrimental to corals and stromatoporoids are less likely to affect borers.

In one of the few comparable studies on ancient bioerosion, Kobluk and Nemcsok (1982) examined trepostome bryozoans (*Prasopora*) from the Caradocian (Late Ordovician) calcarenites and hardgrounds of Kirkfield, Ontario. They found that 52% of their samples contained *Trypanites*. The boring frequency observed in *Prasopora* is similar to off-reef boring frequencies found in dense host substrates from Anticosti Island. It is, therefore, likely that comparable levels of bioerosion measured from Anticosti Island had already existed by the early Late Ordovician and were present in separate basins. Despite numerous records of Paleozoic off-reef bioerosion (especially in hardgrounds), few reports targeting reefs have led to the erroneous perception that Ordovician and Silurian bioerosion was rare. Founded on 1,700 references, even the Paleoreef Maps database mistakenly lists Llandovery reefs as having no evidence of bioerosion (Kiessling et al., 1999).

A SYNTHESIS OF EARLY TO MIDDLE PALEOZOIC BIOEROSION

Despite over a dozen described boring ichnogenera (Häntzschel, 1975; Kobluk et al., 1978), bioerosion during the Cambrian-Devonian interval was clearly dominated by *Trypanites* in both reef and off-reef carbonate marine settings. A number of papers have reviewed the development of bioerosion through the Paleozoic, but have restricted their scope to a specific setting (e.g. reefs: Vogel, 1993, coarse mobile clasts: Wilson, 1987; hardgrounds: Palmer, 1982; rocky shores: Johnson and Baarli, 1999). From these, and other accounts of *Trypanites*, a more complete picture of Early to Middle Paleozoic bioerosion has emerged (Text-figure 28).

After appearing abundantly in Early Cambrian archaeocyathid reefs and adjacent hardgrounds (James et al., 1977), *Trypanites* appear to be absent in the geologic record until the Early



Text-figure 28: Occurrence of *Trypanites* in reef and off-reef carbonate settings of the Early-Middle Paleozoic. Highlighted interval based on material from Anticosti Island, Québec.

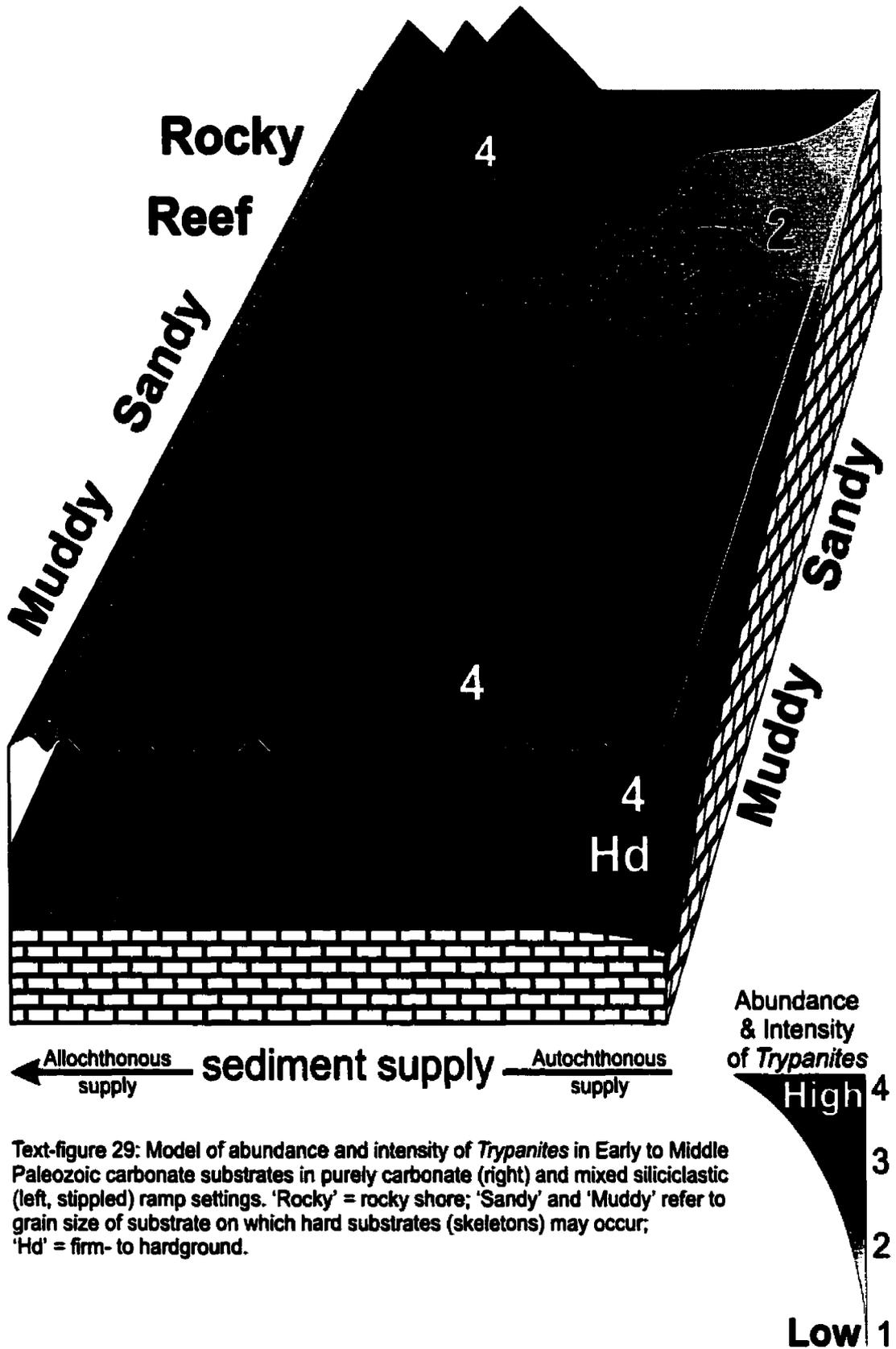
Ordovician, when they reappear abundantly in hardgrounds (Arenig: Rozhnov, 1994). In the Middle Ordovician ('Chazyan', Llanvirn-Llandeilo of the Lake Champlain area, Vermont), *Trypanites* are found in stromatoporoid reefs (Kapp, 1975) and the ancient Laurentian rocky shoreline north of present-day Anticosti Island (Mingan Formation, Llandeilo: Desrochers and James, 1988). By the Caradoc, *Trypanites*-dominated bioerosion had penetrated most carbonate hard substrates in the marine realm. These included hardgrounds, rocky shores, coarse mobile clasts, and skeletal limestones from reef and off-reef facies (Text-figure 28). With the diversification of boring fauna in the Ordovician (Kobluk et al., 1978), *Trypanites* maintained its dominance among macroborers, occurring in various substrates through the remainder of the Paleozoic. Although large sponge borings (e.g. *Topsentopsis* and *Clionolithes*) have been reported from the Late Silurian and Devonian, it was not until the Mesozoic when excavations by sponges and deep boring bivalves usurped *Trypanites* as the dominant macroborings. Although recently reduced in importance, compared to total bioerosion, *Trypanites* has remained a significant component of marine bioerosion for over half a billion years.

The frequent occurrence of *Trypanites* in off-reef facies during the Early-Middle Paleozoic implies that macroborers were not dependent on reefs for habitable substrates (Text-figure 29). Extensive hardgrounds and rocky coastlines would have provided ample hard substrates to accommodate *Trypanites*. The *Trypanites* domichnia is well adapted for the severe scour associated with hardgrounds and coastlines (Palmer, 1982). Limited predation in rocky shores (Johnson and Baarli, 1999) and enhanced nutrient supply, indicated by phosphatic hardground crusts, may have benefited suspension-feeding borers off-reef. With an apparent preference for dense hard substrates and low sediment supply (this study), macroborers found hardgrounds to be a suitable habitat. The greater porosity typical of most skeletal substrates reduces, but does not prohibit, bioerosion. Results from Anticosti Island (this study) and Norway (Caradoc: Opalinski and Harland, 1980) show that skeletal substrates from off-reef facies were preferentially bored compared to reefs. In both cases, burial rate and substrate density were suggested to be limiting factors on bioerosion. Clearly, off-reef settings, including hardgrounds and rocky shores, were

common sites for *Trypanites* and, therefore need not be considered a 'refuge' (sensu Kobluk et al., 1978).

Kobluk et al. (1978) suggest that competition for space and nutrients in reefs may have limited *Trypanites*. They argue that the 'high stress' of the reef environment was responsible for the diversification of macroborers in the Late Ordovician and Early Devonian. Other authors imply that the diversification of macroborers and reefs is linked, suggesting that the restriction of bioerosion to hardgrounds resulted in low macroborer diversity (James et al., 1977; Hutchings, 1986). It is here suggested that macroborer diversity and reef development may be mostly coincident, since most new innovations in macrobioerosion occurred off-reef. It is possible that *Trypanites* adapted to or evolved for hardgrounds prior to the intense episodes of bioerosion during the Early Cambrian (Kobluk et al., 1978). Despite a current lack of evidence, the abundant occurrence of *Trypanites* in the Early Ordovician suggests that they probably inhabited hardgrounds of the Middle to Late Cambrian (Kobluk et al., 1978). Not only did *Trypanites* originate in off-reef hardgrounds, but also nearly all 13 other ichnogenera listed by Kobluk et al. (1978) were from shell beds, biostromes and other off-reef settings. For example, the bivalve borings *Petroxestes pera* (Pojeta and Palmer, 1976; Wilson and Palmer, 1988) and *Gastrochaenolites* (Ekdale et al., 2000) first appear off-reef in skeletal substrates and hardgrounds. *P. pera* has never been found in reefs and *Gastrochaenolites* has only been found in post-Paleozoic reefs (Wilson and Palmer, 1998). The Ordovician radiation resulted in the diversification of many groups, including reef-building and macroboring organisms. No clear evidence exists to show that reef development was responsible for macroboring diversification during this time. Paleozoic macroboring, defined by *Trypanites*, originated and remained dominant in off-reef settings. Though significant in reefal substrates, bioerosion in reefs did not intensify until the Mesozoic diversification of boring bivalves and clionid sponges, possibly in response to rising predation (Wood, 1997), as is suggested for other marine fauna (Vermeij, 1977; Signor and Brett, 1984).

The offshore-onshore evolution of macrobioerosion opposes the concept of migration of benthos proposed by Jablonski et al. (1983), who suggested that ecological innovations appear



Text-figure 29: Model of abundance and intensity of *Trypanites* in Early to Middle Paleozoic carbonate substrates in purely carbonate (right) and mixed siliciclastic (left, stippled) ramp settings. 'Rocky' = rocky shore; 'Sandy' and 'Muddy' refer to grain size of substrate on which hard substrates (skeletons) may occur; 'Hd' = firm- to hardground.

nearshore and migrate offshore with new innovations. For example, boring bivalves originated in offshore hardgrounds and mudstones (e.g. *Corallidomus scobina*, Wilson and Palmer, 1988) and later spread to nearshore reefs and rocky shores. Johnson and Baarli (1999) argued against the onshore-offshore model for fauna in modern rocky shores. Most of these faunas, including macroborers, originated in subtidal environments and migrated to the rocky shore to escape competition and predation. Brett (1988) compared the evolution of hard substrate infauna to the onshore-offshore model, where relict fauna were said to 'migrate' to cryptic and protected surfaces. Worm borings (i.e. *Trypanites*) do not fit this model, occurring as the dominant non-cryptic macroborers in some modern reefs (e.g. Madagascar: Peyrot-Clausade and Brunel, 1990; Florida: Hein and Risk, 1975). In comparing borers from mobile clasts, Wilson (1987) has noted that *Trypanites* are dominant in the Paleozoic, but are restricted to high energy environments in the Mesozoic. This suggests a nearshore 'migration' of *Trypanites*, likely in response to the increased exploitation of mobile clasts by large boring bivalves in the Mesozoic. Where substrate depth is less limiting, *Trypanites* may not have been forced out of environments with the addition of new bioeroders. Vertical niche partitioning (tiering) first described for soft-sediment infauna (Ausich and Bottjer, 1982; Bottjer and Ausich, 1986) was also common among post-Paleozoic bioeroders. Tiering in borers (Bromley and Asgaard, 1993) may have developed with increased diversity, as observed in soft-sediment infauna (Droser and Bottjer, 1989). Consequently, competition for substrate space with the addition of new macroborers through time has been mitigated. Despite tiering, reduction of hard substrates by long-term bioerosion (taphonomic feedback) and intense surface grazing (scarids and echinoids) eventually limited substrate exploitation.

CONCLUSIONS

- 1) Bioerosion was a common process in corals and stromatoporoids from reef and off-reef settings from Anticosti, affecting at least 40% of samples.
- 2) Macroborings are dominated by *Trypanites* (a probable sipunculid or polychaete worm boring), with rare occurrences of *Petroxestes pera* (a probable bivalve boring), and were most

commonly excavated in dead host skeletons. Definitive sponge macroborings were absent in corals and stromatoporoids. Microborings, excavated by microbial, fungal, and/or algal microborers, are present, but require further study for proper identification.

3) Macroborings were most common in muddy off-reef facies, moderate in sandy off-reef facies and least common in reefs. Reduced exposure time of the host substrate surface to the watermass is suggested to account for the observed differences in boring frequency between facies. Off-reef, exposure time is probably most limited by sediment burial, which was greatest in sandy off-reef facies than in muddy off-reef facies. In reefs, competition for space by skeletonized and non-skeletonized encrusting epizoans were the likely cause for reduced exposure time of the host substrate.

4) In general, skeletal density of host substrate was positively correlated with boring frequency. The advantage of residing in a more durable domichnia appears to have offset the extra effort required to excavate a denser skeleton.

5) In general, host skeletons having higher relief (e.g. high domical) were macrobored more frequently. Such high relief forms enhanced passive shedding of sediment off the host skeleton, slowing down the rate of burial, and extending exposure time of the host surface to the watermass.

6) Early-Middle Paleozoic macrobioerosion is suggested to have evolved in off-reef settings, e.g. hardgrounds, shell beds, rocky shores. While present in many Paleozoic reefs, it is suggested that Ordovician and Devonian radiations in boring ichnotaxa were coincidental, and not the result of, reef development during these times.

7) Two new embedment structures, *Chaetosalpinx rex* n. ichnosp. and *Klemmatoica linguliforma* n. ichnogen & ichnosp., were formed by the sequestration of endosymbionts within a live host skeleton.

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PLATES

Plate 1: *Trypanites*.

Figure 1, Intensely bored (*Trypanites*) surface of host stromatoporoid, *Clathrodictyon*, Sample #1219, Locality A1211, Goéland Member, Jupiter Formation. Scale bar = 1 cm.

Figure 2, Longitudinal section of large *Trypanites* in host coral, *Calapoecia*, Sample #288, Locality A42, Prinsta Member, Ellis Bay Formation. Scale bar = 1 cm.

Figure 3, Longitudinal section of large *Trypanites* in ?*Propora conferta*, Sample #2228, Locality A554, Pavillon Member, Jupiter Formation. Scale bar = 1 cm.

Figure 4, Post-mortem *Trypanites* concentrated on upper overgrown surface of *Ecclimadictyon* (E) and top of *Clathrodictyon* (C), Sample #1128/1129, Locality A1189, Goéland Member, Jupiter Formation. Scale bar = 1 cm.

Figure 5, Longitudinal section of *Trypanites* with bioturbated fill in host coral, ?*Propora*, Sample #2474, Locality A1188, Goéland Member, Jupiter Formation. Scale bar = 1 mm.

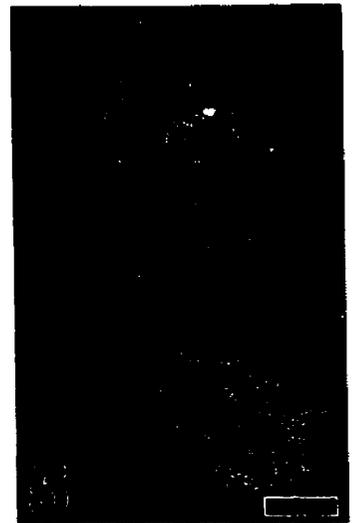


Plate 2: *Trypanites* with exceptional fill in host coral, *Paleofavosites*.

Figure 1, Longitudinal thin section of bored corallite. Tabulae are clearly cut along the corallite wall (w), and lined with micrite (m) surrounding a central cavity filled with calcite spar (s), Sample #1016, Locality A1360, Merrimack Formation. Scale bar = 0.5 mm.

Figure 2, Transverse thin section of bored corallite. Symbols same as for Figure 1, Sample #1016, Locality A1360, Merrimack Formation. Scale bar = 0.5 mm.

Figure 3, Oblique section of bored corallites, Sample #1016, Locality A1360, Merrimack Formation. Scale bar = 1 mm.

Figure 4, Transverse section of bored corallites, Sample #1016, Locality A1360, Merrimack Formation. Scale bar = 1 mm.

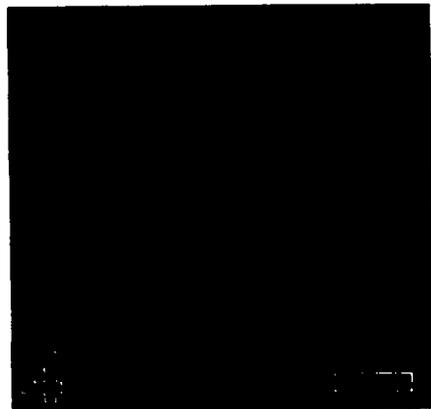
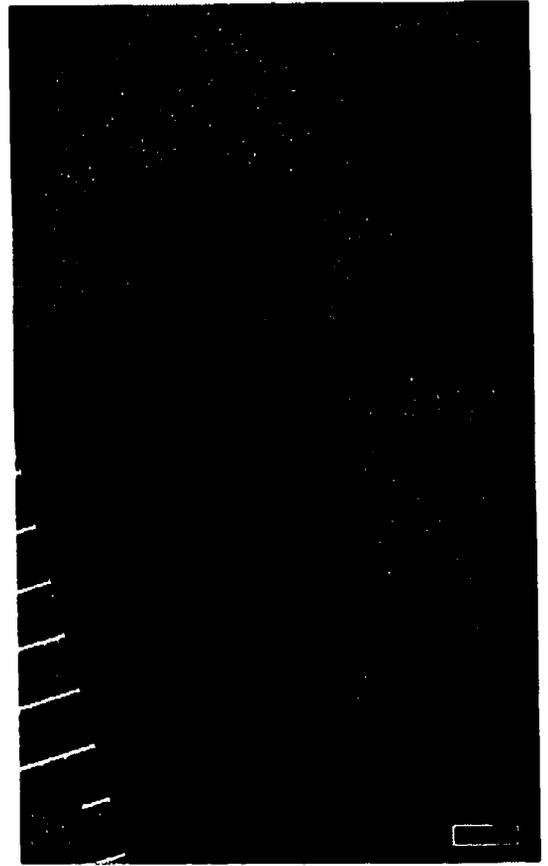


Plate 3: Possible bivalve borings.

Figure 1, Three *Petroxestes pera* (elongate borings) and *Trypanites* in upper surface of *Clathrodictyon*, Sample #649, Locality A759, Goéland Member, Jupiter Formation. Scale bar = 1 cm.

Figure 2, *Petroxestes pera* (P), *Trypanites* (T), and *Klemmatoica linguliforma* n. ichnogen. & ichnosp. (K) in host stromatoporoid, *Clathrodictyon*, Sample #1014, Locality A1109c, Goéland Member, Jupiter Formation. Scale bar = 1 cm.

Figure 3, Longitudinal section of *Petroxestes pera* in host stromatoporoid, *Clathrodictyon*, Sample #652, Locality A1179, Goéland Member, Jupiter Formation. Scale bar = 1cm.

Figure 4, Longitudinal section of flask-shaped ?*Gastrochaenolites* (G?) in host stromatoporoid, *Clathrodictyon*, Sample #1132, Locality A835, Goéland Member, Jupiter Formation. Scale bar = 1 cm.

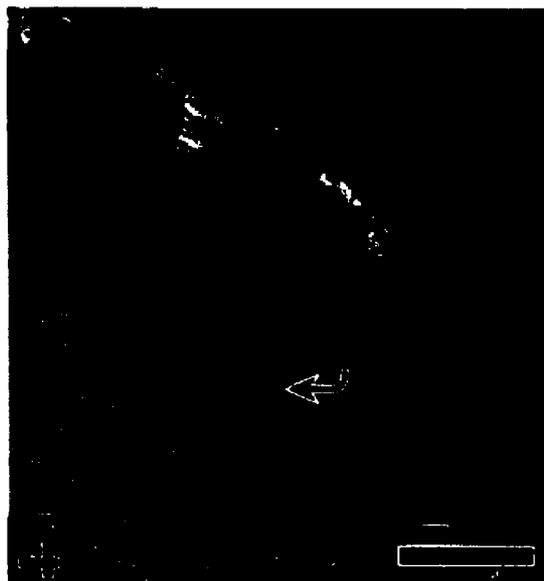
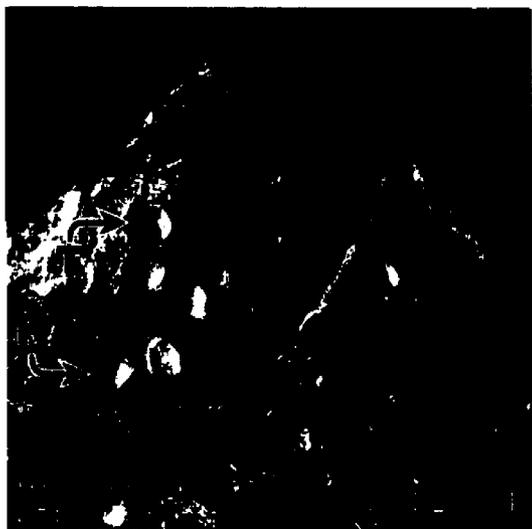
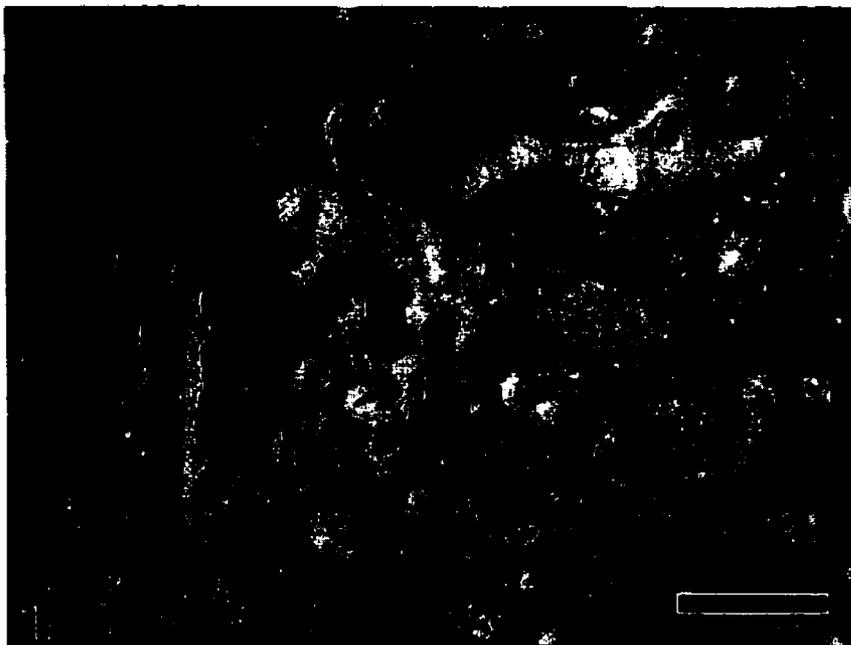


Plate 4: Unnamed microborings in Anticosti samples.

Figure 1, Longitudinal thin section of spar-filled filamentous microborings in host coral, *Ellisites labechioides*, Sample #393, Locality A1271, Prinsta Member, Ellis Bay Formation. Scale bar = 0.1 mm.

Figure 2, Detail of Figure 1. Scale bar = 0.1 mm.

Figure 3, Longitudinal thin section of halysitid corallite wall (right of dashed line) containing microborings (globular) filled with pyrite spherules, Locality A961, East Point Member, Jupiter Formation. Scale bar = 0.1 mm.

Figure 4, Longitudinal thin section of *Propora conferta* containing pyrite-filled filamentous microborings, Locality A1175, Laframboise Member, Ellis Bay Formation. Scale bar = 0.25 mm.

Figure 5, Longitudinal thin section of halysitid coral penetrated by long, sinuous microboring (b), Locality A41, Laframboise Member, Ellis Bay Formation. Scale bar = 0.5 mm.

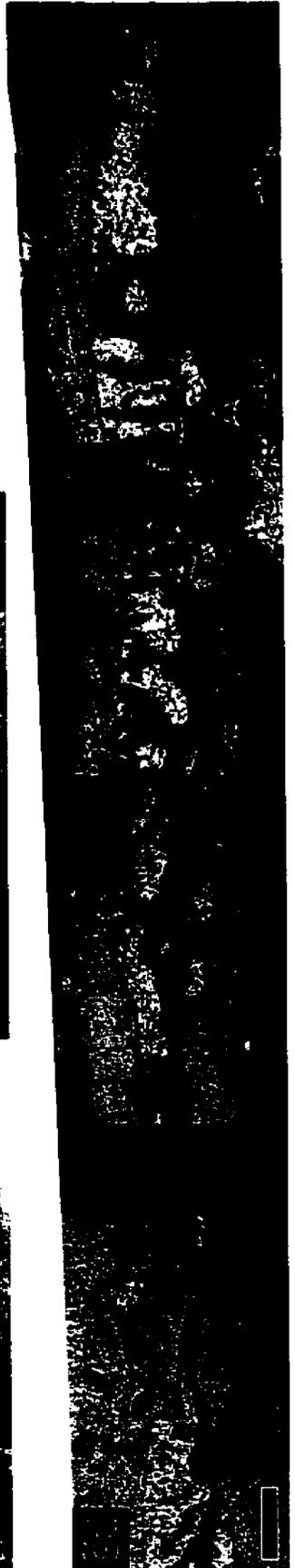


Plate 5: Branched microboring.

Figure 1, Diagram of *Reticulina elegans* Radtke microboring (adapted from Glaub, 1999). Scale bar = 0.1 mm.

Figure 2, Longitudinal thin section of branched microborings in host coral, *Acidolites*, Sample #578, Locality A1191, Laframboise Member, Ellis Bay Formation. Scale bar = 0.1 mm.

Figure 3, Longitudinal thin section of microboring in host coral, *Acidolites*. Branching of three orders propagates upwards from base of host coral, parallel to host corallite axis, Sample #578, Locality A1191, Laframboise Member, Ellis Bay Formation. Scale bar = 0.1 mm.

Figure 4, Longitudinal thin section of host coral *Acidolites* penetrated by microboring with ovoid swelling, Locality A1194-21, Laframboise Member, Ellis Bay Formation. Scale bar = 0.1 mm.

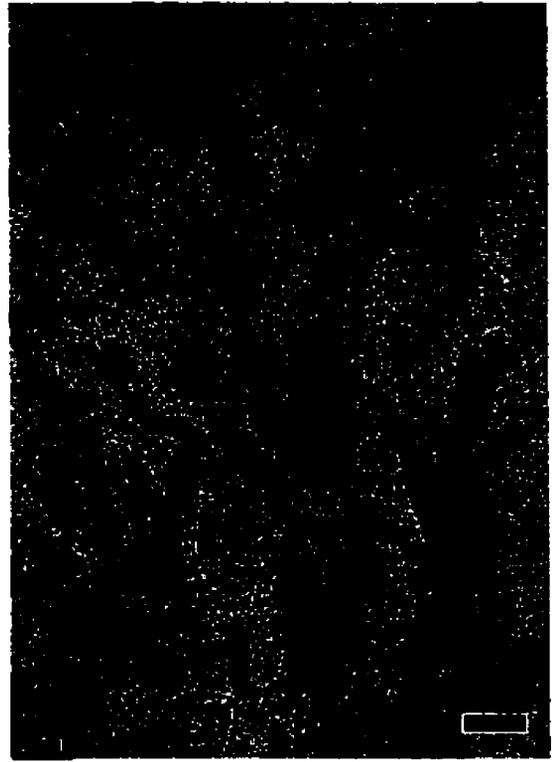
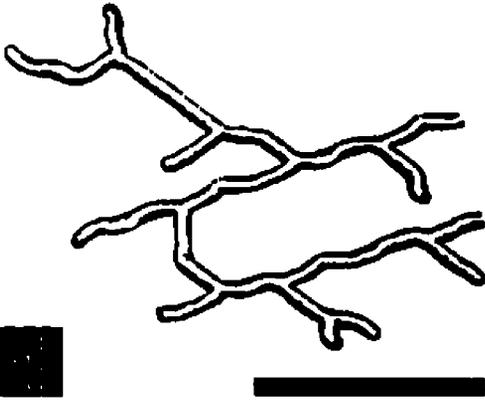


Plate 6: *Chaetosalpinx* in host coral, *Columnopora*.

Figure 1, *Chaetosalpinx* in coral septa, Sample #40, Locality A1399, Mill Bay Member, Vauréal Formation. Scale bar = 0.25 mm.

Figure 2, *Chaetosalpinx rex* n. ichnosp. apertures of small middle segment (m) and large proximal segment (p) visible at surface of host coral, *Columnopora*, Sample #1048, Locality 1399, Mill Bay Member, Vauréal Formation. Scale bar = 1 cm.

Figure 3, Longitudinal thin section of proximal (p), middle (m), and distal (d) segments of *Chaetosalpinx rex* n. ichnosp., Sample #40, Locality A1399, Mill Bay Member, Vauréal Formation. Scale bar = 1 mm.

Figure 4, Transverse thin section of host coral *Columnopora* corallites (c) truncated by numerous proximal (p), middle (m), and distal (d) segments of *Chaetosalpinx rex* n. ichnosp., Sample #1048, Locality A1399, Mill Bay Member, Vauréal Formation. Scale bar = 1 mm.

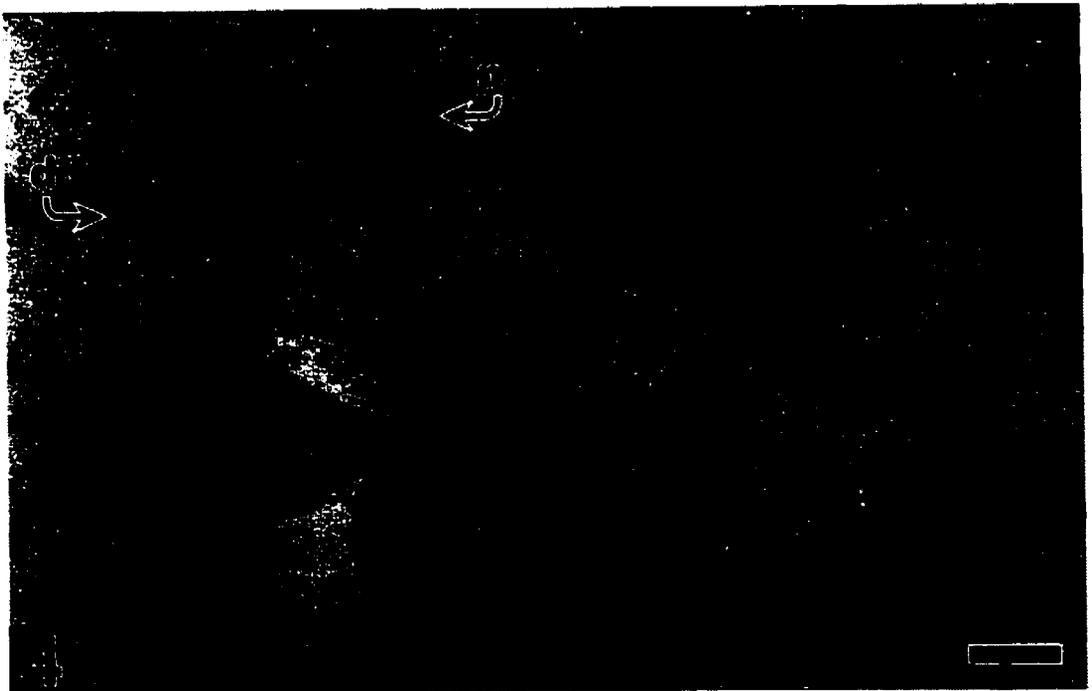


Plate 7: *Klemmatoica linguliforma* n. ichnogen. & ichnosp. in host stromatoporoid *Clathrodictyon*.

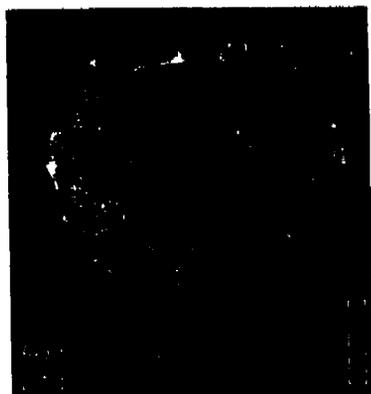
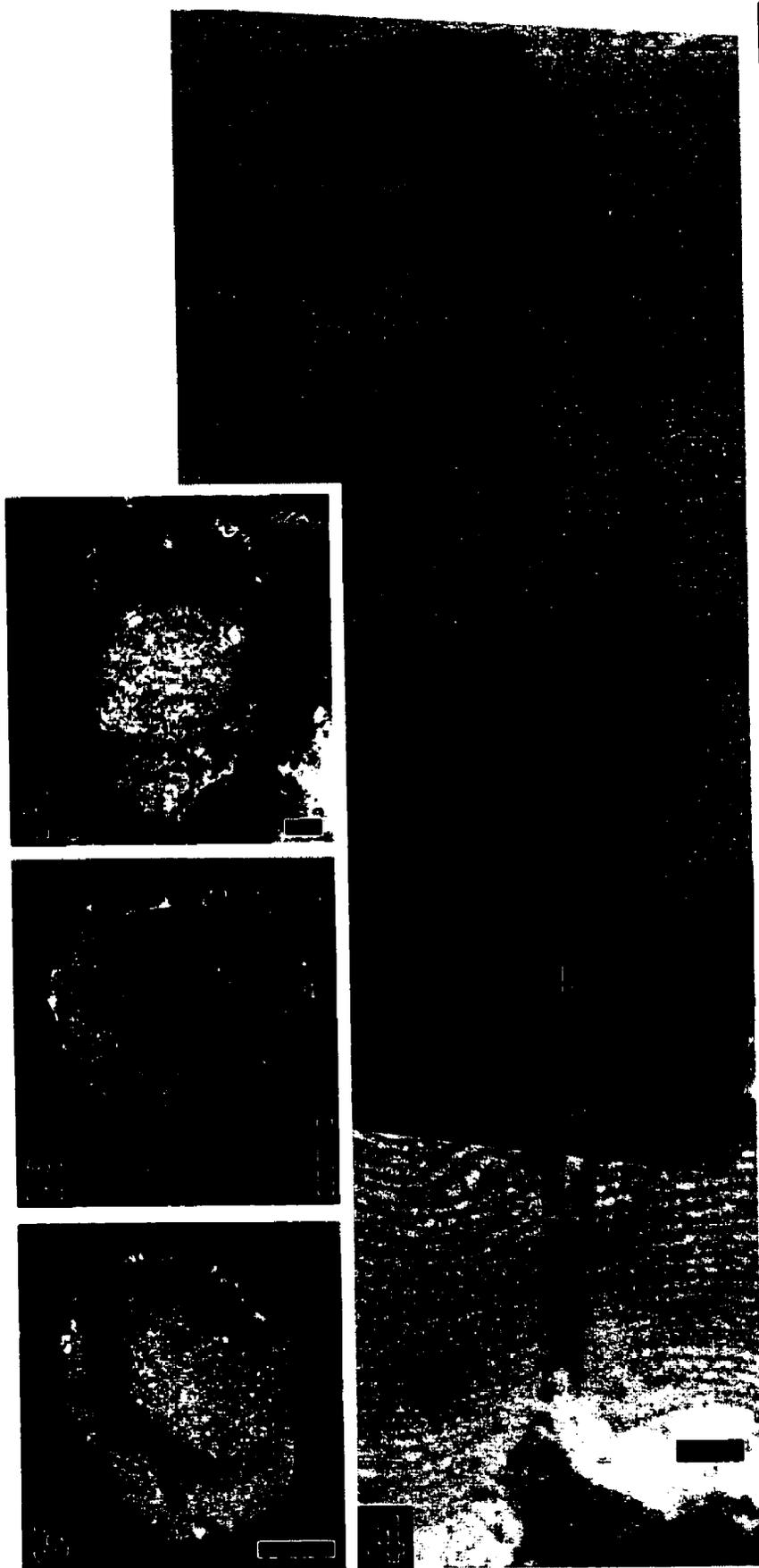
Figure 1: Lenticular aperture at surface of host stromatoporoid, Sample #1022, Locality A1179, Goéland Member, Jupiter Formation. Scale bar = 1 mm.

Figure 2: Transverse section of two overlapping *Klemmatoica linguliforma* n. ichnogen. & ichnosp. cavities, each with distinct micritic fills, Sample #1022, Locality A1179, Goéland Member, Jupiter Formation. Scale bar = 1 mm.

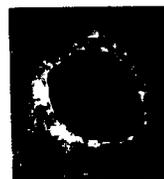
Figure 3: Transverse section of lenticular, pyritized outline of micritic fill in large extended-*Trypanites* cavity, Sample #1022, Locality A1179, Goéland Member, Jupiter Formation. Scale bar = 1 mm.

Figure 4: Composite longitudinal thin section of lingulid preserved with ?pedicle (p) in extended-*Trypanites* cavity. Arrows mark deflected laminae, denoting transition between *Trypanites* (base of cavity) and *Klemmatoica linguliforma* n. ichnogen. & ichnosp. (upper portion of cavity), Sample #1022, Locality A1179, Goéland Member, Jupiter Formation. Scale bar = 1 mm.

Figure 5: Serial cross-section through extended-*Trypanites* cavity, just below host stromatoporoid surface (i) to *Trypanites* base (ix). Light-coloured diagenetic halo surrounds the trace, Sample #1022, Locality A1179, Goéland Member, Jupiter Formation. Scale bar = 1 mm.



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Plate 8: *Chaetosalpinx rex* n. ichnosp. and *Klemmatoica linguliforma* n. ichnogen. & ichnosp.

Figure 1, Two adjacent lenticular *Chaetosalpinx rex* n. ichnosp. apertures separated by thin host coral (*Columnopora*) skeletal partition. Two small middle segment apertures of *C. rex* near top of image, Sample #40, Locality A1399, Mill Bay Member, Vauréal Formation. Scale bar = 1 mm.

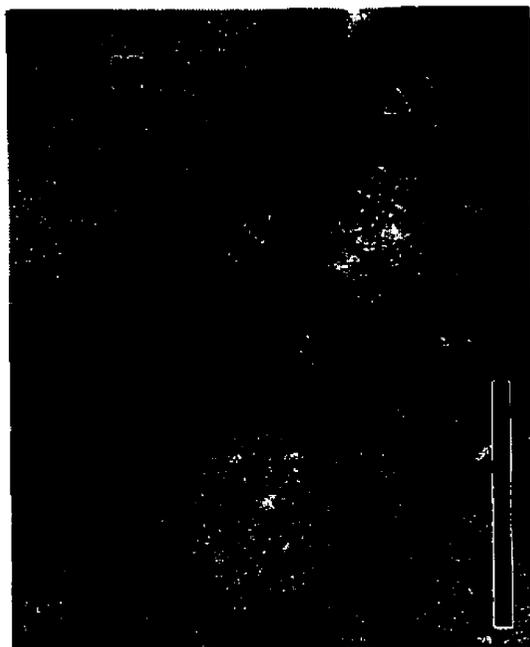
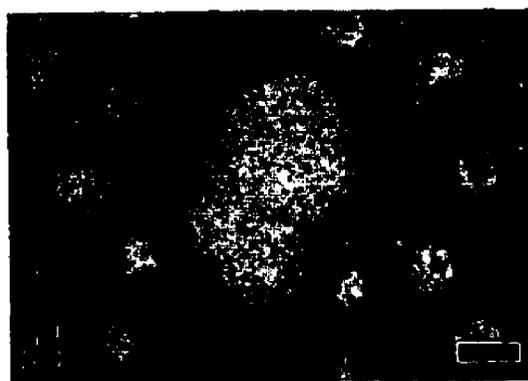
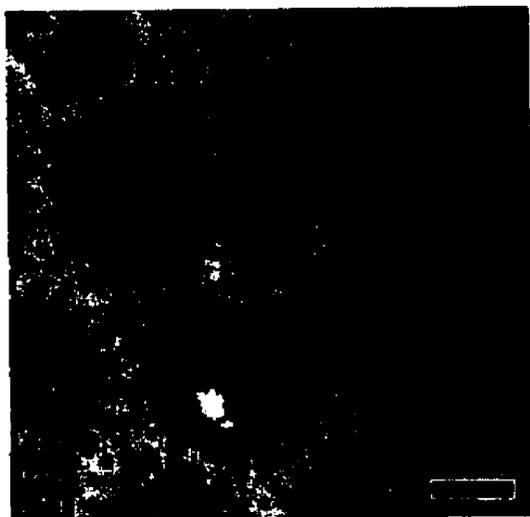
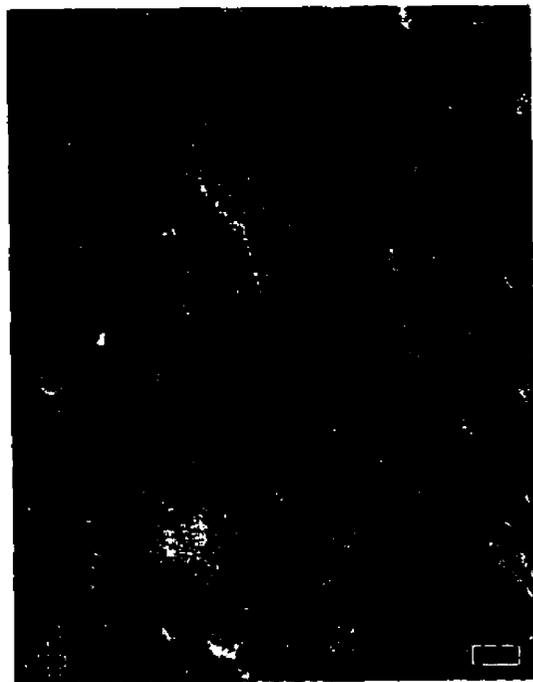
Figure 2, Transverse section of lenticular *Chaetosalpinx rex* n. ichnosp. sharply deflecting four adjacent host *Columnopora* corallites, Sample #40, Locality A1399, Mill Bay Member, Vauréal Formation. Scale bar = 1 mm.

Figure 3, Lenticular aperture of *Klemmatoica linguliforma* n. ichnogen. & ichnosp. in host coral ?*Propora* surface, Sample #2474, Locality A1188, Goéland Member, Jupiter Formation. Scale bar = 1 mm.

Figure 4, Two adjacent lenticular *Klemmatoica linguliforma* n. ichnogen. & ichnosp. in host coral ?*Propora* surface, Sample #2474, Locality A1188, Goéland Member, Jupiter Formation. Scale bar = 1 mm.

Figure 5, Two 'overlapping' lenticular apertures of *Klemmatoica linguliforma* n. ichnogen. & ichnosp. in ?*Propora* surface, Sample #2474, Locality A1188, Goéland Member, Jupiter Formation. Scale bar = 1 mm.

Figure 6, Arrows point between raised margin of *Klemmatoica linguliforma* n. ichnogen. & ichnosp. (K) and adjacent corallite wall at surface of host coral, ?*Propora*, Sample #2474, Locality A1188, Goéland Member, Jupiter Formation. Scale bar = 1 mm.



APPENDIX A: BRIEF DESCRIPTIONS OF CORAL AND STROMATOPOROID TAXA

The following are brief descriptions of host skeletal substrates from Anticosti Island. Except where noted, all descriptions are based on those compiled by Hill (1981). Approximate corallite diameter size (CDS) and skeletal density (SD) were determined from Anticosti samples only.

Tabulate corals

Favositids

Ceroid; thin-walled, polygonal, prismatic, corallites; septa reduced to spines; subhorizontal tabulae complete; mural pores on corallite faces.

Favosites sp.

Mural pores in middle of corallite faces. CDS = 1-6 mm ; SD = 17%.

Paleofavosites sp.

Mural pores at extreme edge of corallite faces. CDS = 1-6 mm; SD = 36%.

Multisoleniids

Ceroid, pseudomeandroid; thin-walled, cylindropismatic corallites; septa reduced, subhorizontal tabulae complete.

Multisolenia sp.

Same as family description. CDS = 0.5 mm; SD = 34%.

Heliolitids

Corallum massive with cylindrical tabularia surrounded by coenenchyme of prismatic tubules, with or without diaphragms; commonly 12 spinose septa; subhorizontal tabulae complete.

'Heliolites' sp.

Tabularia oval to round; coenenchyme of prismatic tubules with transverse diaphragms.

CDS = 0.5-1 mm; SD = 50%.

Propora speciosa

Wide, often crenulate tabularia; coenenchyme of domed plates penetrated by rod-like trabeculae (Dixon, 1974). CDS = 3 mm; SD = 33%.

Propora conferta

Slender, round tabularia; coenenchyme of domed plates without rod-like trabeculae (Dixon, 1974). CDS = 1 mm; SD = 39%.

Ellisites labechioides

Tabularia formed of short, longitudinally discontinuous trabecular ring; skeleton dominated by non-trabecular zones of transverse vesicular elements (Dixon et al., 1986). CDS = 1 mm; SD = 62%.

Ellisites astomata

Similar to *E. labechioides*, except trabecular elements are dominant, and transverse vesicular zones rare to absent (Dixon et al., 1986). CDS = 1 mm; SD = 92%.

***Protochiscolithus* sp.**

Septa of slender trabeculae crossed by tabulae; coenenchyme narrow crossed by diaphragms; skeletal elements perforated. CDS = 1 mm; SD = 61%.

***Pycnolithus* sp.**

Tabularia with short septa crossed by subhorizontal tabulae; coenenchyme of dilated vertical trabeculae; longitudinal skeletal elements greatly thickened. CDS = 1 mm; SD = 76%.

***Acidolites* sp.**

Corallites formed of partially dilated septa crossed by tabulae, or fully dilated septa with no tabulae. Septa abut to form columella of vertical trabeculae; coenenchyme variably dilated, crossed with diaphragms (Dixon, 1986). CDS = 1 mm; SD = 93%.

Sarcinulids***Calapoecia* sp.**

Corallum coenenchymate, walls of corallites greatly thickened, often forming stereozone, with pores in regular, intersecting horizontal and vertical rows; spinose septa commonly 20; coenenchyme thin; corallites circular to subpolygonal; tabulae complete and sagging. CDS = 1-6 mm; SD = 44%.

***Columnopora* sp.**

Same as *Calapoecia* sp., with the following exceptions: walls of corallites shared, not greatly thickened, often reduced to laterally separated septa; coenenchyme (inter-corallite space) greatly reduced, often absent. CDS = 3mm; SD = 37%.

Theciids***Thecia* sp.**

Ceroid; thick, contiguous septa, commonly 12, formed of longitudinal row of trabeculae producing stereozone; mural pores present. CDS = 1 mm; SD = 68%.

Alveolitids

Massive; slender, branched, reclined corallites opening obliquely to surface; walls may be thickened; reduced spinose septa; tabulae horizontal. CDS = 0.5 mm; SD = 45%.

Rugose corals*Arachnophyllum* sp.

Astreoid to aphroid; tabulae steeply domed with wide dissepimentarium formed of numerous cyst plates. Septa thickened and contiguous, or forming dense layer of trabeculae perpendicular to curvature of cysts. CDS = 10-15 mm; SD = 26%.

Palaeareaea sp.

Astreoid with steeply everted calices near periphery. Axial ends of large septa forming spongy axial structure; tabulae domed and widely separated. CDS = 10 mm ; SD = 47%.

StromatoporoidsAulacerids

Columnar; axis made of large, upwardly curved, thin cyst plates (macrocyts); lateral skeleton latilaminar, formed of smaller, imbricated cysts (microcyts); lateral pillars may or may not be present (Galloway, 1957). SD of lateral microcyts = 40%.

Other stromatoporoids*Clathrodictyon* sp.

Massive to laminar skeleton composed of imperfect cyst plates, placed side by side, not imbricated; short pillars oblique and continuous with cyst plates (Galloway, 1957). SD = 57%.

Ecclimadictyon sp.

Massive to laminar skeleton composed of chevron-like crumpled laminae; laminae interconnect at summits without distinct pillars (Mori, 1968). SD = 57%.

Pachystroma sp.

Strongly latilaminar skeleton separated by thin sediment layers; skeleton dominated by thickened vertical coenosteles (walls) and cysts (Stearn, 1993). SD = 100%.

APPENDIX B: ANTICOSTI SAMPLE DATA SET

The following are abbreviations used in the data set:

S# = Sample number

Fm = Formation

C = Chicotte

J = Jupiter

GR = Gun River

M = Merrimack

B = Becscie

EB = Ellis Bay

V = Vauréal

Mbr = Member

P = Pavillon

F = Ferrum

C = Cybèle

R = Richardson

EP = East Point

G = Goéland

M = MacGilvray

S = Sandtop

I = Innommée

Lt = Lachute

Ch = Chabot

FP = Fox Point

L = Laframboise

LC = Lousy Cove

P = Prinista

V = Velleda

Gr = Grindstone

SC = Schmitt Creek

MB = Mill Bay

JP = Joseph Point

H = Homard

T = Tower

E = Easton

Fc = Facies

R = Reef; S = Sandy Off-reef; M = Muddy Off-reef

Ord = Order

Tb = Tabulate coral

St = Stromatoporoid sponge

Fam = Family

aiv = alveolitid

fav = favositid

hel = heliolitid

mul = multisoleniid

sar = sarcinulid

the = theciid

aul = aulacerid

— = non-aulacerid stromatoporoids

Shp = Shape of host coral or stromatoporoid substrate

T = Tabular; L = Low Domical; D = Domical; H = High Domical; M = Multi-lobate; S = Sub-spheroidal; C = Columnar

MMI = Maximum macroboring intensity (see Table 1)

Trace & Lingulid = Occurrence of macroborings, embedment structures and nestling lingulids

T = *Trypanites*; P = *Petroxestes pera*; C = *Chaetosapinx rex* n. ichnosp.; K = *Klemmatoica linguliforma* n. ichnogen. & ichnosp.; L = Lingulid brachiopod nestler

S#	Fm	Mbr	Locality	No.	Fc	Host Substrate				MMI	Trace & Linguid
						Ord	Fam	Genus	Shp		
2310	C		A1234	12	R	St	—	<i>Clathrodictyon</i>	T	1	T
2354	C		A1234		R	St	—	<i>Plumatalinia</i>	T	0	
2353	C		A1234		R	Tb	hel	? <i>Heliolites</i>	L	0	
2356	C		A1236		S	Tb	fav	? <i>Mesofavosites</i>	L	0	
2297	C		A1236		S	Tb	hel	? <i>Heliolites</i>	T	1	T
2319	C		A1348		R	St	—	?	L	2	T
2322	C		A1348		R	St	—	?	L	0	
2323	C		A1348		R	St	—	?	D	0	
2324	C		A1348		R	St	—	?	T	0	
2327	C		A1348		R	St	—	?	T	0	
2329	C		A1348		R	St	—	?	T	2	T
2336	C		A1348	1	R	St	—	? <i>Ecclimadictyon</i>	T	1	T
2350	C		A1348		R	Tb	alv	<i>Subalveolites</i>	D	1	T
2351	C		A1348		R	Tb	alv	<i>Subalveolites</i>	T	0	
2237	C		A1348	4	R	Tb	fav	<i>Favosites</i>	T	0	
2320	C		A1348		R	Tb	fav	<i>Paleofavosites</i>	T	1	T
2326	C		A1348		R	Tb	fav	<i>Paleofavosites</i>	T	1	T
2328	C		A1348		R	Tb	fav	<i>Paleofavosites</i>	T	2	T
2321	C		A1348		R	Tb	hel	<i>Heliolites</i>	L	1	T
2325	C		A1348		R	Tb	hel	?	L	1	T
1255	C		A1351		R	St	—	<i>Pachystroma</i>	T	0	
2337	C		A1351		R	St	—	?	T	0	
2340	C		A1351		R	St	—	<i>Densastroma</i>	L	0	
2276	C		A1351		R	Tb	alv	<i>Subalveolites</i>	H	0	
2272	C		A1352	7	R	St	—	<i>Pachystroma</i>	L	0	
2301	C		A1352	17	R	St	—	<i>Pycnodictyon</i>	D	0	
2302	C		A1352	16	R	St	—	<i>Pycnodictyon</i>	L	0	
2304	C		A1352		R	St	—	<i>Plumatalinia</i>	L	0	
2307	C		A1352	12	R	St	—	<i>Pachystylostroma</i>	T	0	
2308	C		A1352	18	R	St	—	<i>Plumatalinia</i>	L	1	T
2309	C		A1352		R	St	—	<i>Plumatalinia</i>	T	0	
2313	C		A1352	22	R	St	—	<i>Clathrodictyon</i>	L	1	T
2315	C		A1352	22	R	St	—	<i>Clathrodictyon</i>	L	0	
2317	C		A1352	14	R	St	—	<i>Clathrodictyon</i>	T	0	
2260	C		A1352	1	R	Tb	alv	<i>Subalveolites</i>	D	0	
2265	C		A1352		R	Tb	alv	<i>Subalveolites</i>	D	0	
2266	C		A1352		R	Tb	alv	<i>Subalveolites</i>	L	0	
2270	C		A1352	1	R	Tb	alv	<i>Subalveolites</i>	D	0	
2251	C		A1352		R	Tb	fav	<i>Paleofavosites</i>	L	0	
2264	C		A1352	8	R	Tb	fav	<i>Paleofavosites</i>	T	0	
2282	C		A1352	1	R	Tb	fav	<i>Paleofavosites</i>	L	0	
2314	C		A1352	22	R	Tb	fav	<i>Mesofavosites</i>	L	0	
2252	C		A1352	13	R	Tb	hel	<i>Heliolites</i>	L	4	T
2316	C		A1352	10	R	Tb	hel	<i>Heliolites</i>	T	1	T
2283	C		A1352	1	R	Tb	the	<i>Thecia</i>	L	0	
2284	C		A1352	2	R	Tb	the	<i>Thecia</i>	T	0	
2318	C		A1352	14	R	Tb	the	<i>Thecia</i>	D	0	
1248	C		A1356b	4	S	St	—	<i>Pachystroma</i>	L	0	
2300	C		A1356b	31	S	St	—	<i>Clathrodictyon</i>	D	0	
2343	C		A1356b	5	S	St	—	<i>Clathrodictyon</i>	H	1	T
2274	C		A1356b	1	S	Tb	alv	<i>Subalveolites</i>	D	2	T
2275	C		A1356b		S	Tb	alv	<i>Subalveolites</i>	L	0	
2277	C		A1356b		S	Tb	alv	<i>Subalveolites</i>	L	0	

2305	C	A1356b	3	S	Tb	alv	?Subalveolites	D	1	T
2306	C	A1356b		S	Tb	alv	?Subalveolites	L	1	T
2342	C	A1356b		S	Tb	alv	?Subalveolites	T	1	T
2352	C	A1356b		S	Tb	alv	Subalveolites	L	0	
2243	C	A1356b	5	S	Tb	fav	Paleofavosites	L	1	T
2244	C	A1356b	2	S	Tb	fav	Paleofavosites	L	1	T
2299	C	A1356b	31	S	Tb	hel	Pycnolithus	D	2	T
2349	C	A251		R	St	—	Lophiostroma	T	0	
1	C	A263		S	Tb	fav	Favosites	T	1	T
2345	C	A268	1	S	St	—	Lophiostroma	L	0	
2346	C	A268		S	St	—	Lophiostroma	L	0	
2347	C	A268		S	St	—	Lophiostroma	T	0	
2348	C	A268		S	St	—	Lophiostroma	L	0	
2286	C	A268		S	Tb	the	Thecia	L	0	
1254	C	A276		S	St	—	Desmostroma	T	0	
2285	C	A283		M	St	—	?	L	1	T
2271	C	A283		M	Tb	alv	Subalveolites	H	0	
2339	C	A416	1	S	St	—	Ecclimadictyon	L	0	
2290	C	A416		S	Tb	hel	Pycnolithus	T	2	T
2238	C	A449	2	R	Tb	fav	Mesofavosites	T	0	
2239	C	A449		R	Tb	fav	Mesofavosites	T	0	
2240	C	A449		R	Tb	fav	Mesofavosites	T	0	
2241	C	A449		R	Tb	fav	Mesofavosites	T	0	
2255	C	A449	1	R	Tb	fav	Paleofavosites	T	0	
2280	C	A449		R	Tb	hel	?Heliolites	L	0	
2281	C	A501-3		R	Tb	hel	Protrochiscolithus	D	4	T
2330	C	A831	1	S	St	—	Ciathrodictyon	L	0	
2331	C	A831	3	S	St	—	Ciathrodictyon	D	0	
2355	C	A831		S	St	—	?	H	1	T
2344	C	A831		S	Tb	alv	?Subalveolites	L	1	T
2229	C	A831	1B	S	Tb	fav	Mesofavosites	L	0	
2230	C	A831	4	S	Tb	fav	Mesofavosites	T	0	
2231	C	A831	2	S	Tb	fav	Mesofavosites	L	0	
2232	C	A831	3B	S	Tb	fav	Mesofavosites	L	0	
2233	C	A831		S	Tb	fav	?Favosites	T	0	
2234	C	A831		S	Tb	fav	?Favosites	T	0	
2235	C	A831		S	Tb	fav	?Favosites	T	0	
2236	C	A831		S	Tb	fav	Favosites	T	0	
2248	C	A831		S	Tb	fav	?Mesofavosites	T	1	T
2249	C	A831		S	Tb	fav	?Mesofavosites	T	1	T
2278	C	A831	2	S	Tb	hel	?Heliolites	L	0	
2287	C	A831		S	Tb	hel	?	T	0	
2288	C	A831		S	Tb	mul	?Multisolenia	T	2	T
1036	C	A832		R	St	—	?Pachystylostroma	D	1	T
1249	C	A832	63	R	St	—	Pachystroma	D	0	
2246	C	A832		R	St	—	Ciathrodictyon	D	1	T
2259	C	A832		R	St	—	Ciathrodictyon	L	1	T
2311	C	A832		R	St	—	?Pachystroma	D	0	
2312	C	A832	31	R	St	—	Pachystroma	D	0	
2335	C	A832	38	R	St	—	Ciathrodictyon	D	1	T
2338	C	A832		R	St	—	?Plumatalinia	T	0	
2256	C	A832		R	Tb	alv	Subalveolites	L	1	T
2257	C	A832		R	Tb	alv	Subalveolites	L	1	T
2258	C	A832		R	Tb	alv	Subalveolites	L	1	T
2269	C	A832	37	R	Tb	alv	Subalveolites	T	0	

2273	C		A832	36	R	Tb	alv	<i>Subalveolites</i>	L	0	
2245	C		A832		R	Tb	fav	<i>Mesofavosites</i>	H	0	
2250	C		A832		R	Tb	fav	<i>Paleofavosites</i>	L	1	T
2253	C		A832		R	Tb	fav	? <i>Mesofavosites</i>	L	1	T
2254	C		A832	31	R	Tb	fav	<i>Paleofavosites</i>	T	1	T
2268	C		A832		R	Tb	fav	<i>Paleofavosites</i>	L	1	T
2279	C		A832		R	Tb	fav	<i>Paleofavosites</i>	T	3	T
1052	C		A832		R	Tb	the	<i>Thecia</i>	T	0	
2263	C		A832		R	Tb	the	<i>Thecia</i>	T	0	
2267	C		A832		R	Tb	the	<i>Thecia</i>	T	1	T
2357	C		A832a		R	St	—	<i>Pachystroma</i>	L	0	
1246	C		A832b	32	R	St	—	<i>Pachystroma</i>	L	0	
1041	C		A832c	30	R	St	—	<i>Pachystroma</i>	L	0	
1252	C		A832d		R	St	—	<i>Pachystroma</i>	L	1	T
1253	C		A832e		R	St	—	<i>Pachystroma</i>	L	0	
1251	C		A832g		R	St	—	<i>Pachystroma</i>	L	0	
1250	C		A832h		R	St	—	<i>Pachystroma</i>	H	1	T
1247	C		A832j	62	R	St	—	<i>Pachystroma</i>	D	0	
2298	C		A984		S	Tb	alv	<i>Subalveolites</i>	L	1	T
2242	C		A984		S	Tb	fav	? <i>Favosites</i>	T	1	T
2289	C		A985		R	Tb	fav	? <i>Mesofavosites</i>	T	0	
2247	C		A985		R	Tb	the	<i>Thecia</i>	T	1	T
1107	J	P	A105		S	St	—	<i>Clathrodictyon</i>	L	0	
1108	J	P	A105		S	St	—	<i>Clathrodictyon</i>	L	1	T
1109	J	P	A105		S	St	—	<i>Clathrodictyon</i>	L	0	
2223	J	P	A105		S	St	—	<i>Clathrodictyon</i>	D	0	
2552	J	P	A105		S	St	—	<i>Actinodictyon</i>	L	0	
1088	J	P	A105	2	S	Tb	alv	? <i>Subalveolites</i>	S	1	T
2216	J	P	A105	6	S	Tb	alv	? <i>Subalveolites</i>	L	1	T
2217	J	P	A105	7	S	Tb	alv	? <i>Subalveolites</i>	L	1	T
2221	J	P	A105	9	S	Tb	alv	? <i>Subalveolites</i>	D	1	T
2200	J	P	A105		S	Tb	fav	<i>Favosites</i>	T	0	
2201	J	P	A105		S	Tb	fav	<i>Favosites</i>	T	0	
2202	J	P	A105		S	Tb	fav	<i>Favosites</i>	T	0	
2203	J	P	A105		S	Tb	fav	<i>Favosites</i>	T	0	
2204	J	P	A105		S	Tb	fav	<i>Favosites</i>	L	0	
2205	J	P	A105		S	Tb	fav	<i>Favosites</i>	T	0	
2206	J	P	A105		S	Tb	fav	<i>Favosites</i>	T	0	
2207	J	P	A105		S	Tb	fav	<i>Favosites</i>	T	0	
2208	J	P	A105	5	S	Tb	fav	<i>Favosites</i>	T	0	
2210	J	P	A105		S	Tb	fav	<i>Favosites</i>	T	0	
2211	J	P	A105		S	Tb	fav	<i>Favosites</i>	T	0	
2222	J	P	A105	1	S	Tb	fav	<i>Paleofavosites</i>	L	1	T
2209	J	P	A105		S	Tb	hel	?	T	0	
2212	J	P	A105		S	Tb	hel	?	T	1	T
2213	J	P	A105	12	S	Tb	hel	?	L	1	T
2214	J	P	A105		S	Tb	hel	?	L	1	T
2215	J	P	A105		S	Tb	hel	?	L	1	T
2218	J	P	A105	3	S	Tb	the	<i>Thecia</i>	T	1	T
2219	J	P	A105		S	Tb	the	<i>Thecia</i>	T	0	
2220	J	P	A105	2	S	Tb	the	<i>Thecia</i>	T	0	
1089	J	P	A107		S	St	—	? <i>Ecclimadictyon</i>	L	1	T
1090	J	P	A107		S	St	—	? <i>Ecclimadictyon</i>	L	0	
1091	J	P	A107		S	St	—	? <i>Ecclimadictyon</i>	L	1	T
1092	J	P	A107		S	St	—	<i>Clathrodictyon</i>	D	0	

2192	J	P	A107		S	Tb	fav	<i>Paleofavosites</i>	L	1	T
2193	J	P	A107		S	Tb	fav	<i>Paleofavosites</i>	L	0	
2191	J	P	A107		S	Tb	hel	<i>Heliolites</i>	D	0	
2194	J	P	A107		S	Tb	hel	?	L	1	T
2126	J	P	A1079		S	Tb	hel	<i>Heliolites</i>	L	1	T
2198	J	P	A1089		M	Tb	alv	? <i>Subalveolites</i>	L	1	T
2199	J	P	A1089		M	Tb	fav	<i>Favosites</i>	T	0	
1072	J	P	A1095		S	St	—	<i>Clathrodictyon</i>	D	1	T
2068	J	P	A1095		S	Tb	fav	<i>Favosites</i>	T	0	
2067	J	P	A1095		S	Tb	mul	? <i>Multisolenia</i>	D	1	T
965	J	P	A1346		M	Tb	fav	<i>Paleofavosites</i>	L	0	
966	J	P	A1346		M	Tb	fav	<i>Paleofavosites</i>	D	0	
967	J	P	A1346		M	Tb	hel	<i>Propora conferta</i>	D	3	T
1112	J	P	A1347		S	St	—	<i>Clathrodictyon</i>	T	0	
1114	J	P	A1347		S	St	—	<i>Clathrodictyon</i>	D	0	
1115	J	P	A1347		S	St	—	<i>Ecclimadictyon</i>	D	0	
1116	J	P	A1347		S	St	—	<i>Ecclimadictyon</i>	D	0	
1117	J	P	A1347		S	St	—	<i>Clathrodictyon</i>	L	3	T
1113	J	P	A1347		S	Tb	fav	? <i>Paleofavosites</i>	L	0	
947	J	P	A1355		S	St	—	? <i>Clathrodictyon</i>	D	2	T
953	J	P	A1356a		S	St	—	<i>Clathrodictyon</i>	L	1	T
958	J	P	A1356a		S	St	—	<i>Clathrodictyon</i>	D	0	
959	J	P	A1356a		S	St	—	<i>Clathrodictyon</i>	D	2	T
960	J	P	A1356a		S	St	—	? <i>Ecclimadictyon</i>	L	0	
961	J	P	A1356a		S	St	—	? <i>Ecclimadictyon</i>	D	1	T
1073	J	P	A1356a		S	St	—	<i>Clathrodictyon</i>	L	2	T
2107	J	P	A1356a		S	St	—	<i>Clathrodictyon</i>	D	0	
952	J	P	A1356a		S	Tb	fav	<i>Favosites</i>	L	0	
954	J	P	A1356a		S	Tb	fav	<i>Favosites</i>	H	1	T
955	J	P	A1356a		S	Tb	fav	<i>Paleofavosites</i>	L	1	T
956	J	P	A1356a		S	Tb	fav	<i>Favosites</i>	L	2	T
957	J	P	A1356a		S	Tb	hel	<i>Heliolites</i>	D	1	T
950	J	P	A1395		S	St	—	<i>Ecclimadictyon</i>	L	1	T
951	J	P	A1395		S	Tb	alv	? <i>Subalveolites</i>	L	0	
949	J	P	A1395		S	Tb	fav	<i>Favosites</i>	T	0	
948	J	P	A1395		S	Tb	hel	? <i>Propora conferta</i>	D	1	T
962	J	P	A155		S	St	—	<i>Densastroma</i>	D	0	
1111	J	P	A155		S	St	—	<i>Ecclimadictyon</i>	L	0	
1099	J	P	A157b	1	S	Tb	alv	? <i>Subalveolites</i>	T	0	
1100	J	P	A157b	2	S	Tb	alv	? <i>Subalveolites</i>	T	0	
1101	J	P	A157b		S	Tb	alv	? <i>Subalveolites</i>	D	0	
2108	J	P	A157b		M	Tb	fav	<i>Favosites</i>	T	1	T
2129	J	P	A167		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
2130	J	P	A167		M	Tb	fav	<i>Paleofavosites</i>	D	2	T
2131	J	P	A167		M	Tb	fav	<i>Paleofavosites</i>	L	1	T
1102	J	P	A243		S	St	—	? <i>Ecclimadictyon</i>	D	0	
1103	J	P	A243		S	St	—	? <i>Ecclimadictyon</i>	D	1	T
1104	J	P	A243		S	St	—	? <i>Ecclimadictyon</i>	T	1	T
1105	J	P	A243		S	St	—	<i>Clathrodictyon</i>	L	1	T
2124	J	P	A243		S	Tb	fav	<i>Paleofavosites</i>	T	2	T
2125	J	P	A243		S	Tb	hel	?	L	2	T
1074	J	P	A244	1	M	St	—	<i>Clathrodictyon</i>	T	1	T
2105	J	P	A244		M	Tb	hel	?	T	0	
2173	J	P	A244a		M	St	—	<i>Clathrodictyon</i>	D	0	
2172	J	P	A244b		M	St	—	<i>Clathrodictyon</i>	D	0	

2170	J	P	A244e		M	St	—	<i>Clathrodictyon</i>	T	0	
2171	J	P	A244e		M	Tb	fav	<i>Favosites</i>	T	0	
2184	J	P	A245		M	Tb	fav	<i>Paleofavosites</i>	L	3	T
2185	J	P	A245		M	Tb	fav	<i>Paleofavosites</i>	D	0	
2186	J	P	A245		M	Tb	fav	<i>Paleofavosites</i>	L	0	
2187	J	P	A245		M	Tb	fav	<i>Paleofavosites</i>	D	2	T
2188	J	P	A245		M	Tb	fav	<i>Paleofavosites</i>	L	0	
2132	J	P	A253		S	Tb	fav	<i>Favosites</i>	T	0	
1080	J	P	A279b		S	Tb	alv	? <i>Subalveolites</i>	L	0	
2189	J	P	A279b		S	Tb	alv	? <i>Subalveolites</i>	T	1	T
2190	J	P	A279b		S	Tb	hel	?	L	1	T
2119	J	P	A281		M	Tb	hel	<i>Heliolites</i>	L	1	T
1071	J	P	A281a	1	M	St	—	<i>Clathrodictyon</i>	S	2	T
1069	J	P	A281b	2	M	St	—	<i>Clathrodictyon</i>	D	0	
1070	J	P	A281c	3	M	St	—	<i>Ecclimadictyon</i>	D	1	T
2155	J	P	A326-7		M	Tb	alv	? <i>Subalveolites</i>	L	3	T
2150	J	P	A326-7		M	Tb	fav	<i>Favosites</i>	D	0	
2153	J	P	A326-7		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
2154	J	P	A326-7		M	Tb	fav	<i>Favosites</i>	L	0	
2151	J	P	A326-7		M	Tb	hel	<i>Heliolites</i>	L	3	T
2152	J	P	A326-7		M	Tb	hel	<i>Heliolites</i>	D	1	T
1110	J	P	A331	1	M	St	—	<i>Clathrodictyon</i>	D	1	T
2160	J	P	A331		M	St	—	?	D	1	T
2174	J	P	A331		M	St	—	<i>Clathrodictyon</i>	L	1	T
2175	J	P	A331		M	St	—	<i>Ecclimadictyon</i>	D	1	T
2176	J	P	A331		M	St	—	<i>Ecclimadictyon</i>	H	1	T
2177	J	P	A331		M	St	—	<i>Clathrodictyon</i>	H	0	
2178	J	P	A331		M	St	—	<i>Ecclimadictyon</i>	L	1	T
2179	J	P	A331		M	St	—	<i>Ecclimadictyon</i>	L	1	T
2180	J	P	A331		M	St	—	<i>Clathrodictyon</i>	L	1	T
2181	J	P	A331		M	St	—	<i>Clathrodictyon</i>	L	1	T
2182	J	P	A331		M	St	—	<i>Ecclimadictyon</i>	D	0	
2161	J	P	A331	2	M	Tb	alv	? <i>Subalveolites</i>	L	2	T
2163	J	P	A331		M	Tb	fav	<i>Paleofavosites</i>	D	3	T
2164	J	P	A331		M	Tb	fav	<i>Paleofavosites</i>	L	1	T
2165	J	P	A331		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
2166	J	P	A331		M	Tb	fav	<i>Paleofavosites</i>	L	0	
2156	J	P	A331		M	Tb	hel	?	L	1	T
2157	J	P	A331		M	Tb	hel	<i>Heliolites</i>	D	0	
2158	J	P	A331		M	Tb	hel	?	D	1	T
2159	J	P	A331		M	Tb	hel	?	D	1	T
2183	J	P	A331		M	Tb	hel	?	H	3	T
2162	J	P	A331	2	M	Tb	mul	<i>Multisolenia</i>	L	0	
1081	J	P	A333-4	1	S	St	—	<i>Clathrodictyon</i>	L	0	
1082	J	P	A333-4	2	S	St	—	<i>Clathrodictyon</i>	L	0	
1083	J	P	A333-4		S	Tb	alv	? <i>Subalveolites</i>	L	0	
1084	J	P	A333-4		S	Tb	alv	? <i>Subalveolites</i>	D	1	T
2167	J	P	A333-4		S	Tb	hel	?	T	0	
2168	J	P	A333-4		S	Tb	hel	?	T	0	
2169	J	P	A333-4		S	Tb	mul	<i>Multisolenia</i>	T	1	T
1106	J	P	A418-5		S	St	—	<i>Clathrodictyon</i>	L	2	T
2291	J	P	A418-5		S	St	—	<i>Clathrodictyon</i>	T	2	T
2292	J	P	A418-5		S	St	—	<i>Clathrodictyon</i>	T	1	T
2293	J	P	A418-5		S	St	—	<i>Clathrodictyon</i>	L	3	T
2294	J	P	A418-5		S	St	—	<i>Clathrodictyon</i>	T	1	T

2295	J	P	A418-5		S	St	—	<i>Clathrodictyon</i>	T	1	T
2296	J	P	A418-5		S	St	—	<i>Clathrodictyon</i>	D	1	T
1079	J	P	A418-5		S	Tb	alv	? <i>Subalveolites</i>	H	1	T
1094	J	P	A418-5		S	Tb	alv	? <i>Subalveolites</i>	T	0	
1095	J	P	A418-5		S	Tb	alv	? <i>Subalveolites</i>	L	3	T
1096	J	P	A418-5		S	Tb	alv	? <i>Subalveolites</i>	T	1	T
2133	J	P	A418-5		S	Tb	fav	<i>Favosites</i>	T	0	
2134	J	P	A418-5		S	Tb	fav	<i>Favosites</i>	T	0	
2136	J	P	A418-5		S	Tb	fav	<i>Favosites</i>	L	0	
2142	J	P	A418-5		S	Tb	fav	<i>Favosites</i>	L	1	T
2143	J	P	A418-5		S	Tb	fav	<i>Favosites</i>	D	1	T
2144	J	P	A418-5		S	Tb	fav	<i>Favosites</i>	H	1	T
2145	J	P	A418-5		S	Tb	fav	<i>Favosites</i>	D	2	T
1077	J	P	A418-5		S	Tb	hel	? <i>Propora conferta</i>	L	1	T
1078	J	P	A418-5		S	Tb	hel	<i>Heliolites</i>	D	4	T
2135	J	P	A418-5		S	Tb	hel	?	T	0	
2137	J	P	A418-5		S	Tb	hel	?	L	1	T
2146	J	P	A418-5		S	Tb	hel	<i>Propora conferta</i>	D	1	T
2138	J	P	A418-5		S	Tb	mul	<i>Multisolenia</i>	L	1	T
2139	J	P	A418-5		S	Tb	mul	<i>Multisolenia</i>	L	1	T
2140	J	P	A418-5		S	Tb	mul	<i>Multisolenia</i>	L	2	T
2141	J	P	A418-5		S	Tb	mul	<i>Multisolenia</i>	L	1	T
2196	J	P	A457d		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
2103	J	P	A457de		M	Tb	alv	? <i>Subalveolites</i>	L	2	T
2110	J	P	A457de		M	Tb	fav	<i>Favosites</i>	L	0	
2111	J	P	A457de		M	Tb	fav	<i>Favosites</i>	T	0	
2116	J	P	A458b		S	Tb	alv	? <i>Subalveolites</i>	D	0	
2112	J	P	A458b		S	Tb	fav	<i>Favosites</i>	T	0	
2117	J	P	A458b		S	Tb	fav	<i>Favosites</i>	L	0	
2118	J	P	A458b		S	Tb	fav	<i>Favosites</i>	L	0	
2113	J	P	A458b		S	Tb	hel	<i>Heliolites</i>	D	1	T
2109	J	P	A459a		M	Tb	fav	<i>Paleofavosites</i>	T	1	T
2102	J	P	A459a		M	Tb	hel	?	D	2	T
1118	J	P	A554	4	S	St	—	<i>Clathrodictyon</i>	D	1	T
1119	J	P	A554	1	S	St	—	<i>Clathrodictyon</i>	D	4	T
1093	J	P	A554		S	Tb	alv	? <i>Subalveolites</i>	L	1	T
2104	J	P	A554	2	S	Tb	alv	? <i>Subalveolites</i>	L	1	T
2225	J	P	A554	1	S	Tb	alv	? <i>Subalveolites</i>	D	2	T
2226	J	P	A554	5	S	Tb	alv	? <i>Subalveolites</i>	D	1	T
2227	J	P	A554	2	S	Tb	alv	? <i>Subalveolites</i>	L	1	T
2228	J	P	A554	3	S	Tb	hel	? <i>Propora conferta</i>	D	2	T
2076	J	P	A560		M	Tb	fav	<i>Favosites</i>	D	0	
2075	J	P	A560		M	Tb	mul	<i>Multisolenia</i>	H	1	T
2303	J	P	A788		M	St	—	<i>Clathrodictyon</i>	L	0	
2332	J	P	A788	1	M	St	—	<i>Ecclimadictyon</i>	L	1	T
2333	J	P	A788	2	M	St	—	? <i>Densastroma</i>	T	0	
2334	J	P	A788	3	M	St	—	? <i>Actinostroma</i>	L	1	T
2261	J	P	A788		M	Tb	alv	<i>Subalveolites</i>	D	0	
2262	J	P	A788		M	Tb	alv	<i>Subalveolites</i>	T	0	
2197	J	P	A788		M	Tb	fav	<i>Paleofavosites</i>	T	1	T
1075	J	P	A790	1	M	St	—	<i>Ecclimadictyon</i>	D	1	T
1076	J	P	A790		M	St	—	<i>Ecclimadictyon</i>	L	2	T
2114	J	P	A790		M	Tb	fav	<i>Paleofavosites</i>	L	0	
2115	J	P	A790		M	Tb	mul	<i>Multisolenia</i>	L	2	T
1244	J	P	A830	3	S	St	—	<i>Ecclimadictyon</i>	D	1	T

1245	J	P	A830	1	S	St	—	<i>Clathrodictyon</i>	L	1	T
2341	J	P	A830	2	S	St	—	<i>Clathrodictyon</i>	D	0	
2120	J	P	A830		S	Tb	fav	<i>Paleofavosites</i>	D	2	T
2121	J	P	A830		S	Tb	fav	<i>Paleofavosites</i>	D	0	
2122	J	P	A830		S	Tb	fav	<i>Paleofavosites</i>	D	0	
2123	J	P	A830		S	Tb	fav	<i>Favosites</i>	T	0	
2127	J	P	A833		S	Tb	hel	?	H	2	T
2106	J	P	A947		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
1097	J	P	A989		S	St	—	<i>Clathrodictyon</i>	D	0	
2224	J	P	A989		S	Tb	hel	?	L	2	T
1087	J	P	A989a		S	St	—	<i>Clathrodictyon</i>	L	1	T
1086	J	P	A989b		S	St	—	<i>Ecclimadictyon</i>	L	2	T
1068	J	P	A994		S	St	—	<i>Ecclimadictyon</i>	D	0	
2077	J	P	A994		S	Tb	hel	? <i>Heliolites</i>	D	2	T
2128	J	P	C671		M	Tb	fav	<i>Favosites</i>	T	0	
2147	J	P/F	A1124		S	Tb	fav	<i>Favosites</i>	L	1	T
2148	J	P/F	A1124		S	Tb	fav	<i>Favosites</i>	L	1	T
2149	J	P/F	A1124		S	Tb	fav	<i>Favosites</i>	L	0	
2055	J	P/F	A156		M	Tb	hel	<i>Heliolites</i>	D	3	T
2195	J	P/F	A156		M	Tb	hel	?	D	2	T
2428	J	F	A1000		M	Tb	fav	<i>Favosites</i>	L	1	T
1930	J	F	A1048		S	Tb	fav	<i>Favosites</i>	D	0	
1931	J	F	A1048		S	Tb	fav	<i>Favosites</i>	L	0	
1932	J	F	A1048		S	Tb	fav	<i>Favosites</i>	D	1	T
1933	J	F	A1048		S	Tb	fav	<i>Favosites</i>	D	1	T
1934	J	F	A1048		S	Tb	fav	<i>Favosites</i>	D	1	T
1935	J	F	A1048		S	Tb	fav	<i>Favosites</i>	L	0	
2069	J	F	A1067		M	Tb	mul	<i>Multisolenia</i>	T	1	T
2070	J	F	A1067		M	Tb	mul	<i>Multisolenia</i>	L	3	T
2071	J	F	A1079		S	Tb	fav	<i>Favosites</i>	L	1	T
1928	J	F	A1082		M	Tb	fav	<i>Favosites</i>	D	1	T
2429	J	F	A1083		M	Tb	fav	<i>Favosites</i>	H	1	T
1929	J	F	A1325		M	Tb	fav	<i>Favosites</i>	D	1	T
1945	J	F	A1344		M	Tb	fav	<i>Favosites</i>	D	3	T
2064	J	F	A274		S	Tb	fav	<i>Paleofavosites</i>	D	0	
2063	J	F	A274		S	Tb	mul	? <i>Multisolenia</i>	T	0	
964	J	F	A278		M	St	—	<i>Clathrodictyon</i>	D	0	
1145	J	F	A278		M	St	—	? <i>Ecclimadictyon</i>	L	1	T
2073	J	F	A278		M	Tb	mul	<i>Multisolenia</i>	L	1	T
2074	J	F	A278		M	Tb	mul	<i>Multisolenia</i>	D	0	
2065	J	F	A335-3		M	Tb	fav	<i>Favosites</i>	L	0	
2066	J	F	A335-3		M	Tb	fav	<i>Favosites</i>	D	0	
2072	J	F	A338		M	Tb	fav	<i>Favosites</i>	D	1	T
1085	J	F	A341a		M	St	—	<i>Clathrodictyon</i>	D	3	T
2054	J	F	A345-4		M	Tb	fav	<i>Favosites</i>	L	0	
1937	J	F	A417-1		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1936	J	F	A417-1		M	Tb	fav	<i>Favosites</i>	D	1	T
2057	J	F	A417-2		M	Tb	fav	<i>Favosites</i>	L	0	
2056	J	F	A417-4		M	Tb	fav	? <i>Paleofavosites</i>	D	1	T
2060	J	F	A54		S	Tb	fav	<i>Favosites</i>	D	1	T
2101	J	F	A556b		M	Tb	fav	<i>Favosites</i>	D	1	T
2099	J	F	A777		M	Tb	fav	<i>Favosites</i>	D	0	
2100	J	F	A777		M	Tb	fav	<i>Favosites</i>	D	1	T
1938	J	F	A782		M	Tb	fav	<i>Favosites</i>	L	0	
1940	J	F	A800		M	Tb	fav	<i>Paleofavosites</i>	D	1	T

963	J	F	A804		M	St	—	<i>Clathrodictyon</i>	T	0	
1134	J	F	A958		M	St	—	<i>Clathrodictyon</i>	D	2	T
1939	J	F	A958		M	Tb	fav	<i>Paleofavosites</i>	D	3	T
2098	J	F	A982		M	Tb	fav	<i>Paleofavosites</i>	D	0	
2061	J	F	C649		M	Tb	mul	? <i>Multisolenia</i>	M	1	T
2062	J	F	C649		M	Tb	mul	? <i>Multisolenia</i>	L	0	
1941	J	F/C	A1300		M	Tb	fav	<i>Favosites</i>	L	1	T
1942	J	F/C	A1300		M	Tb	fav	<i>Favosites</i>	D	1	T
1943	J	F/C	A1300		M	Tb	fav	<i>Favosites</i>	D	0	
1944	J	F/C	A1300		M	Tb	fav	<i>Favosites</i>	D	0	
832	J	C	?		M	Tb	fav	<i>Favosites</i>	D	0	
833	J	C	?		M	Tb	fav	<i>Favosites</i>	D	0	
834	J	C	?		M	Tb	fav	<i>Favosites</i>	D	0	
835	J	C	?		M	Tb	fav	<i>Favosites</i>	D	0	
836	J	C	?		M	Tb	fav	<i>Favosites</i>	D	0	
837	J	C	?		M	Tb	fav	<i>Favosites</i>	H	0	
838	J	C	?		M	Tb	fav	<i>Favosites</i>	D	0	
839	J	C	?		M	Tb	fav	<i>Favosites</i>	L	0	
840	J	C	?		M	Tb	fav	<i>Favosites</i>	D	0	
1434	J	C	A1001		S	Tb	fav	<i>Favosites</i>	D	1	T
1435	J	C	A1001		S	Tb	fav	<i>Favosites</i>	L	1	T
1436	J	C	A1001		S	Tb	fav	<i>Favosites</i>	D	0	
1437	J	C	A1001		S	Tb	fav	<i>Favosites</i>	D	0	
1438	J	C	A1001		S	Tb	fav	<i>Favosites</i>	L	0	
1439	J	C	A1001		S	Tb	fav	<i>Favosites</i>	L	0	
1421	J	C	A1045		S	Tb	mul	<i>Multisolenia</i>	L	0	
1422	J	C	A1045		S	Tb	mul	<i>Multisolenia</i>	D	0	
1371	J	C	A1047		M	Tb	fav	<i>Favosites</i>	D	1	T
1372	J	C	A1047		M	Tb	fav	<i>Favosites</i>	L	0	
1373	J	C	A1047		M	Tb	fav	<i>Favosites</i>	L	1	T
1374	J	C	A1047		M	Tb	fav	<i>Favosites</i>	D	0	
1375	J	C	A1047		M	Tb	fav	<i>Favosites</i>	L	0	
1376	J	C	A1047		M	Tb	fav	<i>Favosites</i>	L	1	T
1377	J	C	A1047		M	Tb	fav	<i>Favosites</i>	S	1	T
1378	J	C	A1047		M	Tb	fav	<i>Favosites</i>	D	0	
1379	J	C	A1047		M	Tb	fav	<i>Favosites</i>	L	1	T
1380	J	C	A1047		M	Tb	fav	<i>Favosites</i>	D	1	T
1946	J	C	A1052		S	Tb	mul	<i>Multisolenia</i>	L	0	
1456	J	C	A1061		S	Tb	mul	<i>Multisolenia</i>	L	1	T
1457	J	C	A1061		S	Tb	mul	<i>Multisolenia</i>	L	1	T
1458	J	C	A1061		S	Tb	mul	<i>Multisolenia</i>	D	0	
1391	J	C	A1063		M	Tb	fav	<i>Favosites</i>	L	0	
1392	J	C	A1063		M	Tb	fav	<i>Favosites</i>	L	0	
1393	J	C	A1063		M	Tb	fav	<i>Favosites</i>	L	2	T
1394	J	C	A1063		M	Tb	fav	<i>Favosites</i>	L	0	
870	J	C	A1064b		M	Tb	fav	<i>Favosites</i>	D	1	T
871	J	C	A1064b		M	Tb	fav	<i>Favosites</i>	D	0	
872	J	C	A1064b		M	Tb	fav	<i>Favosites</i>	D	0	
873	J	C	A1064b		M	Tb	fav	<i>Favosites</i>	D	0	
874	J	C	A1064b		M	Tb	fav	<i>Favosites</i>	D	0	
2058	J	C	A1092		M	Tb	fav	<i>Favosites</i>	D	0	
2059	J	C	A1092		M	Tb	fav	<i>Favosites</i>	D	0	
1947	J	C	A1125		S	Tb	fav	<i>Favosites</i>	D	0	
1948	J	C	A1125		S	Tb	fav	<i>Favosites</i>	D	0	
1949	J	C	A1125		S	Tb	fav	<i>Favosites</i>	D	0	

2005	J	C	A1125		S	Tb	fav	Favosites	D	0	
2006	J	C	A1125		S	Tb	fav	Favosites	D	0	
2007	J	C	A1125		S	Tb	fav	Favosites	D	0	
2008	J	C	A1125		S	Tb	fav	Favosites	D	0	
2009	J	C	A1125		S	Tb	fav	Favosites	D	0	
2010	J	C	A1125		S	Tb	fav	Favosites	D	0	
2011	J	C	A1125		S	Tb	fav	Favosites	D	0	
2012	J	C	A1125		S	Tb	fav	Favosites	D	0	
2013	J	C	A1125		S	Tb	fav	Favosites	D	0	
2014	J	C	A1125		S	Tb	fav	Favosites	D	0	
2015	J	C	A1125		S	Tb	fav	Favosites	D	0	
2016	J	C	A1125		S	Tb	fav	Favosites	D	0	
2017	J	C	A1125		S	Tb	fav	Favosites	D	0	
2018	J	C	A1125		S	Tb	fav	Favosites	D	0	
2019	J	C	A1125		S	Tb	fav	Favosites	D	0	
2020	J	C	A1125		S	Tb	fav	Favosites	D	0	
2021	J	C	A1125		S	Tb	fav	Favosites	D	0	
2022	J	C	A1197		M	Tb	fav	Favosites	H	0	
2023	J	C	A1197		M	Tb	fav	Favosites	H	0	
2024	J	C	A1197		M	Tb	fav	Favosites	L	1	T
854	J	C	A1220b		M	Tb	fav	Favosites	D	0	
855	J	C	A1220b		M	Tb	fav	Favosites	D	1	T
856	J	C	A1220b		M	Tb	fav	Favosites	D	1	T
857	J	C	A1220b		M	Tb	fav	Favosites	D	0	
858	J	C	A1220b		M	Tb	fav	Favosites	D	1	T
859	J	C	A1220b		M	Tb	fav	Favosites	L	0	
860	J	C	A1220b		M	Tb	fav	Favosites	D	1	T
861	J	C	A1220b		M	Tb	fav	Favosites	D	0	
862	J	C	A1220b		M	Tb	fav	Favosites	D	0	
863	J	C	A1220b		M	Tb	fav	Favosites	D	0	
864	J	C	A1220b		M	Tb	fav	Favosites	D	1	T
865	J	C	A1220b		M	Tb	fav	Favosites	D	1	T
866	J	C	A1220b		M	Tb	fav	Favosites	D	0	
867	J	C	A1220b		M	Tb	fav	Favosites	D	1	T
868	J	C	A1220b		M	Tb	fav	Favosites	L	0	
869	J	C	A1220b		M	Tb	fav	Favosites	D	0	
1363	J	C	A1220b		M	Tb	fav	Favosites	D	1	T
1364	J	C	A1220b		M	Tb	fav	Favosites	D	1	T
1365	J	C	A1220b		M	Tb	fav	Favosites	D	0	
1366	J	C	A1220b		M	Tb	fav	Favosites	D	1	T
1367	J	C	A1220b	2	M	Tb	fav	Favosites	D	0	
1368	J	C	A1220b	3	M	Tb	fav	Favosites	D	0	
1369	J	C	A1220b	1	M	Tb	fav	Favosites	L	0	
1370	J	C	A1220b	4	M	Tb	fav	Favosites	D	1	T
1388	J	C	A1221		M	Tb	fav	Favosites	D	0	
1451	J	C	A1313c		M	Tb	fav	Favosites	D	1	T
1452	J	C	A1313c		M	Tb	fav	Favosites	D	1	T
1453	J	C	A1313c		M	Tb	fav	Favosites	D	0	
1454	J	C	A1313c		M	Tb	fav	Favosites	L	1	T
1455	J	C	A1313c		M	Tb	fav	Favosites	L	1	T
1397	J	C	A1313d		M	Tb	fav	Favosites	D	0	
1398	J	C	A1313d		M	Tb	fav	Favosites	D	0	
1399	J	C	A1313d		M	Tb	fav	Favosites	D	1	T
1460	J	C	A163b		M	Tb	fav	Favosites	D	0	
1461	J	C	A163b		M	Tb	fav	Favosites	D	0	

1462	J	C	A163c		M	Tb	fav	<i>Favosites</i>	L	0	
1463	J	C	A163c		M	Tb	fav	<i>Favosites</i>	L	0	
1464	J	C	A163c		M	Tb	fav	<i>Favosites</i>	L	0	
1440	J	C	A749		M	Tb	fav	<i>Favosites</i>	D	1	T
1441	J	C	A749		M	Tb	fav	<i>Favosites</i>	D	1	T
1442	J	C	A749		M	Tb	fav	<i>Favosites</i>	D	0	
1443	J	C	A749		M	Tb	fav	<i>Favosites</i>	D	0	
1444	J	C	A749		M	Tb	fav	<i>Favosites</i>	D	0	
1445	J	C	A749		M	Tb	fav	<i>Favosites</i>	L	0	
1446	J	C	A749		M	Tb	fav	<i>Favosites</i>	L	0	
1447	J	C	A749		M	Tb	fav	<i>Favosites</i>	D	0	
1448	J	C	A749		M	Tb	fav	<i>Favosites</i>	D	0	
1449	J	C	A749		M	Tb	fav	<i>Favosites</i>	D	0	
1450	J	C	A749		M	Tb	fav	<i>Favosites</i>	D	0	
1400	J	C	A847		M	Tb	fav	<i>Favosites</i>	D	0	
1401	J	C	A847		M	Tb	fav	<i>Favosites</i>	D	0	
2025	J	C	A851		M	Tb	fav	<i>Favosites</i>	L	0	
2026	J	C	A851		M	Tb	fav	<i>Favosites</i>	D	0	
2027	J	C	A851		M	Tb	fav	<i>Favosites</i>	D	0	
1396	J	C	A861		S	Tb	fav	<i>Favosites</i>	D	0	
1147	J	C	A864	2	M	St	—	<i>Clathrodictyon</i>	D	1	T
1148	J	C	A864	1	M	St	—	<i>Clathrodictyon</i>	D	2	T
1402	J	C	A865		M	Tb	fav	<i>Favosites</i>	L	1	T
1403	J	C	A865		M	Tb	fav	<i>Favosites</i>	D	1	T
1404	J	C	A865		M	Tb	fav	<i>Favosites</i>	D	0	
1468	J	C	A921		M	Tb	fav	<i>Favosites</i>	D	0	
1469	J	C	A921		M	Tb	fav	<i>Favosites</i>	D	0	
1470	J	C	A921		M	Tb	fav	<i>Favosites</i>	D	0	
1471	J	C	A921		M	Tb	fav	<i>Favosites</i>	D	1	T
1472	J	C	A921		M	Tb	fav	<i>Favosites</i>	D	0	
1473	J	C	A921		M	Tb	fav	<i>Favosites</i>	D	2	T
1474	J	C	A921		M	Tb	fav	<i>Favosites</i>	D	0	
1475	J	C	A921		M	Tb	fav	<i>Favosites</i>	D	0	
1428	J	C	A922		M	Tb	fav	<i>Favosites</i>	D	1	T
1429	J	C	A922		M	Tb	fav	<i>Favosites</i>	D	1	T
1430	J	C	A922		M	Tb	fav	<i>Favosites</i>	L	1	T
1431	J	C	A922		M	Tb	fav	<i>Favosites</i>	D	0	
1432	J	C	A922		M	Tb	fav	<i>Favosites</i>	D	0	
1433	J	C	A922		M	Tb	fav	<i>Favosites</i>	D	0	
1423	J	C	A932		M	Tb	fav	<i>Favosites</i>	L	0	
1424	J	C	A932		M	Tb	fav	<i>Favosites</i>	D	1	T
1425	J	C	A932		M	Tb	fav	<i>Favosites</i>	D	0	
1426	J	C	A932		M	Tb	fav	<i>Favosites</i>	D	1	T
1427	J	C	A932		M	Tb	fav	<i>Favosites</i>	H	1	T
1409	J	C	A937		M	Tb	fav	<i>Favosites</i>	D	0	
1410	J	C	A937		M	Tb	fav	<i>Favosites</i>	D	1	T
1411	J	C	A937		M	Tb	fav	<i>Favosites</i>	D	0	
1412	J	C	A937		M	Tb	fav	<i>Favosites</i>	D	0	
1413	J	C	A937		M	Tb	fav	<i>Favosites</i>	H	0	
1414	J	C	A937		M	Tb	fav	<i>Favosites</i>	L	1	T
1415	J	C	A937		M	Tb	fav	<i>Favosites</i>	D	0	
1416	J	C	A937		M	Tb	fav	<i>Favosites</i>	D	1	T
1417	J	C	A937		M	Tb	fav	<i>Favosites</i>	L	0	
1418	J	C	A937		M	Tb	fav	<i>Favosites</i>	D	0	
1419	J	C	A937		M	Tb	fav	<i>Favosites</i>	D	0	

1420	J	C	A937		M	Tb	fav	<i>Favosites</i>	D	1	T
1405	J	C	A938		M	Tb	fav	<i>Favosites</i>	D	0	
1406	J	C	A938		M	Tb	fav	<i>Favosites</i>	D	0	
1407	J	C	A938		M	Tb	fav	<i>Favosites</i>	D	0	
1408	J	C	A938		M	Tb	fav	<i>Favosites</i>	D	0	
2028	J	C	A939		M	Tb	fav	<i>Favosites</i>	D	0	
1459	J	C	C660		S	Tb	fav	<i>Favosites</i>	D	0	
1386	J	C	C661		M	Tb	fav	<i>Favosites</i>	D	0	
1387	J	C	C661		M	Tb	fav	<i>Favosites</i>	D	1	T
815	J	C/R	A55	2	M	Tb	fav	<i>Favosites</i>	D	1	T
816	J	C/R	A55	1	M	Tb	fav	<i>Favosites</i>	H	0	
817	J	C/R	A55		M	Tb	fav	<i>Favosites</i>	D	0	
1395	J	C/R	A55		M	Tb	fav	<i>Favosites</i>	D	1	T
912	J	R	A1030		M	Tb	fav	<i>Favosites</i>	D	0	
913	J	R	A1030		M	Tb	fav	<i>Favosites</i>	D	0	
914	J	R	A1030		M	Tb	fav	<i>Favosites</i>	D	0	
909	J	R	A1039		M	Tb	fav	<i>Favosites</i>	D	0	
910	J	R	A1039		M	Tb	fav	<i>Favosites</i>	D	1	T
911	J	R	A1039		M	Tb	fav	<i>Favosites</i>	L	0	
1389	J	R	A1064a		M	Tb	fav	<i>Favosites</i>	D	1	T
1390	J	R	A1064a		M	Tb	fav	<i>Favosites</i>	L	0	
1465	J	R	A1158		M	Tb	fav	<i>Favosites</i>	D	0	
1466	J	R	A1158		M	Tb	fav	<i>Favosites</i>	D	0	
1467	J	R	A1158		M	Tb	fav	<i>Favosites</i>	D	0	
892	J	R	A1210		S	Tb	fav	<i>Favosites</i>	D	0	
893	J	R	A1210		S	Tb	fav	<i>Favosites</i>	L	0	
894	J	R	A1210		S	Tb	fav	<i>Favosites</i>	L	0	
895	J	R	A1210		S	Tb	fav	<i>Favosites</i>	D	1	T
821	J	R	A1214		M	Tb	fav	<i>Favosites</i>	D	1	T
822	J	R	A1214		M	Tb	fav	<i>Favosites</i>	D	1	T
823	J	R	A1216		M	Tb	fav	<i>Favosites</i>	D	1	T
824	J	R	A1216		M	Tb	fav	<i>Favosites</i>	D	1	T
825	J	R	A1216		M	Tb	fav	<i>Favosites</i>	D	0	
826	J	R	A1216		M	Tb	fav	<i>Favosites</i>	D	1	T
827	J	R	A1216		M	Tb	fav	<i>Favosites</i>	D	1	T
828	J	R	A1216		M	Tb	fav	<i>Favosites</i>	D	0	
829	J	R	A1216		M	Tb	fav	<i>Favosites</i>	D	0	
830	J	R	A1216		M	Tb	fav	<i>Favosites</i>	D	0	
831	J	R	A1216		M	Tb	fav	<i>Favosites</i>	D	0	
1157	J	R	A1227	2	S	St	—	<i>Ecclimadictyon</i>	D	0	
1165	J	R	A1227		S	St	—	<i>Ecclimadictyon</i>	D	0	
1166	J	R	A1227		S	St	—	<i>Clathrodicyon</i>	D	2	T
841	J	R	A1227		S	Tb	hel	? <i>Propora conferta</i>	L	1	T
842	J	R	A1227		S	Tb	hel	<i>Propora conferta</i>	T	0	
843	J	R	A1227		S	Tb	hel	<i>Propora conferta</i>	L	1	T
1164	J	R	A1227		S	Tb	hel	<i>Propora conferta</i>	L	1	T
1167	J	R	A1227		S	Tb	hel	<i>Propora conferta</i>	L	2	T
1159	J	R	A1227b		S	St	—	<i>Ecclimadictyon</i>	H	0	
1161	J	R	A1227c	1	S	St	—	<i>Ecclimadictyon</i>	D	1	T
1162	J	R	A1227c	1	S	Tb	hel	<i>Propora conferta</i>	D	0	
1160	J	R	A1227d		S	St	—	<i>Ecclimadictyon</i>	D	0	
1158	J	R	A1227e		S	St	—	<i>Ecclimadictyon</i>	D	1	T
880	J	R	A1229		S	St	—	<i>Clathrodicyon</i>	D	0	
1061	J	R	A1229		S	St	—	<i>Ecclimadictyon</i>	D	1	T
1151	J	R	A1229	7	S	St	—	? <i>Ecclimadictyon</i>	D	1	T

1152	J	R	A1229	6	S	St	—	<i>Ecclimadictyon</i>	H	1	T
1154	J	R	A1229	4	S	St	—	<i>Ecclimadictyon</i>	L	0	
875	J	R	A1229		S	Tb	hel	<i>Propora conferta</i>	D	1	T
876	J	R	A1229		S	Tb	hel	<i>Propora conferta</i>	L	1	T
877	J	R	A1229		S	Tb	hel	<i>Propora conferta</i>	L	0	
878	J	R	A1229		S	Tb	hel	<i>Propora conferta</i>	T	0	
879	J	R	A1229		S	Tb	hel	<i>Propora conferta</i>	T	0	
1060	J	R	A1229		S	Tb	hel	<i>Propora conferta</i>	D	1	T
1155	J	R	A1229	4	S	Tb	hel	<i>Propora conferta</i>	L	0	
1153	J	R	A1229c	5	S	St	—	<i>Ecclimadictyon</i>	D	0	
1156	J	R	A1229d	3	S	St	—	<i>Ecclimadictyon</i>	H	0	
818	J	R	A1239		M	Tb	fav	<i>Favosites</i>	D	1	T
819	J	R	A1239		M	Tb	fav	<i>Favosites</i>	D	1	T
820	J	R	A1239		M	Tb	fav	<i>Favosites</i>	L	0	
1149	J	R	A750		S	St	—	<i>Clathrodiclyon</i>	D	0	
1163	J	R	A750	3	S	St	—	<i>Ecclimadictyon</i>	H	0	
924	J	R	A750		S	Tb	fav	<i>Favosites</i>	L	0	
915	J	R	A750		S	Tb	hel	? <i>Propora conferta</i>	T	0	
916	J	R	A750		S	Tb	hel	<i>Propora conferta</i>	L	2	T
917	J	R	A750		S	Tb	hel	<i>Propora conferta</i>	D	1	T
918	J	R	A750		S	Tb	hel	<i>Propora conferta</i>	D	0	
919	J	R	A750		S	Tb	hel	<i>Propora conferta</i>	D	0	
920	J	R	A750		S	Tb	hel	<i>Propora conferta</i>	D	1	T
921	J	R	A750		S	Tb	hel	<i>Propora conferta</i>	D	1	T
922	J	R	A750		S	Tb	hel	<i>Propora conferta</i>	L	1	T
923	J	R	A750		S	Tb	hel	<i>Propora conferta</i>	L	0	
925	J	R	A750		S	Tb	hel	? <i>Propora conferta</i>	L	0	
908	J	R	A848		S	St	—	<i>Clathrodiclyon</i>	M	0	
896	J	R	A848		S	Tb	hel	<i>Propora conferta</i>	T	0	
897	J	R	A848		S	Tb	hel	<i>Propora conferta</i>	L	0	
898	J	R	A848		S	Tb	hel	<i>Propora conferta</i>	L	0	
899	J	R	A848		S	Tb	hel	<i>Propora conferta</i>	L	0	
900	J	R	A848		S	Tb	hel	<i>Propora conferta</i>	T	0	
901	J	R	A848		S	Tb	hel	<i>Propora conferta</i>	D	1	T
902	J	R	A848		S	Tb	hel	<i>Propora conferta</i>	L	0	
903	J	R	A848		S	Tb	hel	<i>Propora conferta</i>	L	0	
904	J	R	A848		S	Tb	hel	<i>Propora conferta</i>	D	0	
905	J	R	A848		S	Tb	hel	<i>Propora conferta</i>	M	0	
906	J	R	A848		S	Tb	hel	<i>Propora conferta</i>	D	0	
907	J	R	A848		S	Tb	hel	<i>Heliolites</i>	D	0	
2029	J	R	A866		M	Tb	fav	<i>Favosites</i>	H	1	T
2030	J	R	A866		M	Tb	fav	<i>Favosites</i>	D	1	T
2031	J	R	A866		M	Tb	fav	<i>Favosites</i>	D	0	
2032	J	R	A866		M	Tb	fav	<i>Favosites</i>	L	0	
2033	J	R	A866		M	Tb	fav	<i>Favosites</i>	D	0	
2034	J	R	A866		M	Tb	fav	<i>Favosites</i>	L	0	
2035	J	R	A866		M	Tb	fav	<i>Favosites</i>	D	0	
2036	J	R	A866		M	Tb	fav	<i>Favosites</i>	L	0	
2037	J	R	A866		M	Tb	fav	<i>Favosites</i>	L	0	
2038	J	R	A866		M	Tb	fav	<i>Favosites</i>	D	0	
2039	J	R	A866		M	Tb	fav	<i>Favosites</i>	D	0	
2040	J	R	A866		M	Tb	fav	<i>Favosites</i>	D	0	
2041	J	R	A866		M	Tb	fav	<i>Favosites</i>	L	0	
1362	J	R	A917c	1	S	St	—	? <i>Ecclimadictyon</i>	D	0	
1150	J	R	A924		M	St	—	<i>Clathrodiclyon</i>	H	1	T

881	J	R	A924c		S	Tb	fav	<i>Favosites</i>	D	0	
882	J	R	A924c		S	Tb	fav	<i>Favosites</i>	D	0	
883	J	R	A924c		S	Tb	fav	<i>Favosites</i>	D	0	
844	J	R	A931		M	Tb	fav	<i>Favosites</i>	D	1	T
845	J	R	A931		M	Tb	fav	<i>Favosites</i>	D	0	
846	J	R	A931		M	Tb	fav	<i>Favosites</i>	L	0	
847	J	R	A931		M	Tb	fav	<i>Favosites</i>	D	1	T
848	J	R	A931		M	Tb	fav	<i>Favosites</i>	D	0	
849	J	R	A931		M	Tb	fav	<i>Favosites</i>	S	0	
850	J	R	A931		M	Tb	fav	<i>Favosites</i>	D	1	T
2380	J	EP	A1059		S	Tb	fav	<i>Favosites</i>	L	1	T
2381	J	EP	A1059		S	Tb	fav	<i>Favosites</i>	D	1	T
2382	J	EP	A1059		S	Tb	fav	<i>Favosites</i>	D	0	
1064	J	EP	A1068a		R	St	—	<i>Clathrodictyon</i>	D	1	T
2095	J	EP	A1112		S	Tb	fav	<i>Favosites</i>	D	1	T
1056	J	EP	A1196	1	S	Tb	alv	? <i>Subalveolites</i>	D	0	
935	J	EP	A1198		R	St	—	?	D	0	
938	J	EP	A1198		R	St	—	?	D	0	
944	J	EP	A1198		R	St	—	?	T	0	
946	J	EP	A1198		R	Tb	alv	? <i>Subalveolites</i>	T	0	
937	J	EP	A1198		R	Tb	fav	<i>Favosites</i>	L	0	
927	J	EP	A1198		R	Tb	hel	<i>Propora conferta</i>	L	0	
928	J	EP	A1198		R	Tb	hel	<i>Propora conferta</i>	L	0	
939	J	EP	A1198		R	Tb	hel	<i>Propora conferta</i>	L	0	
945	J	EP	A1198		R	Tb	hel	<i>Propora conferta</i>	T	0	
926	J	EP	A1198		R	Tb	mul	<i>Multisolenia</i>	T	0	
936	J	EP	A1198		R	Tb	mul	<i>Multisolenia</i>	T	0	
940	J	EP	A1198		R	Tb	mul	<i>Multisolenia</i>	D	0	
941	J	EP	A1198		R	Tb	mul	<i>Multisolenia</i>	L	0	
942	J	EP	A1198		R	Tb	mul	<i>Multisolenia</i>	L	0	
943	J	EP	A1198		R	Tb	mul	<i>Multisolenia</i>	L	0	
2456	J	EP	A1198		R	Tb	mul	<i>Multisolenia</i>	D	0	
1190	J	EP	A1199		S	St	—	<i>Ecclimadictyon</i>	T	0	
1191	J	EP	A1199		S	St	—	<i>Ecclimadictyon</i>	M	0	
1192	J	EP	A1199		S	St	—	?	T	1	T
2080	J	EP	A1199		S	St	—	?	D	0	
2084	J	EP	A1199		S	St	—	?	D	0	
2086	J	EP	A1199		S	St	—	? <i>Forolinia</i>	L	1	T
2078	J	EP	A1199		S	Tb	alv	? <i>Subalveolites</i>	H	0	
1361	J	EP	A1199		S	Tb	fav	<i>Paleofavosites</i>	L	0	
2079	J	EP	A1199		S	Tb	fav	<i>Favosites</i>	D	0	
2082	J	EP	A1199		S	Tb	fav	<i>Favosites</i>	T	0	
2083	J	EP	A1199		S	Tb	fav	<i>Favosites</i>	H	0	
2085	J	EP	A1199		S	Tb	fav	<i>Favosites</i>	L	0	
2087	J	EP	A1199		S	Tb	fav	<i>Favosites</i>	T	0	
2443	J	EP	A1199		S	Tb	fav	<i>Favosites</i>	H	0	
2444	J	EP	A1199		S	Tb	fav	<i>Favosites</i>	C	0	
2445	J	EP	A1199		S	Tb	fav	<i>Favosites</i>	L	0	
2446	J	EP	A1199		S	Tb	fav	<i>Favosites</i>	L	0	
2447	J	EP	A1199		S	Tb	fav	<i>Favosites</i>	L	0	
2448	J	EP	A1199		S	Tb	fav	<i>Favosites</i>	L	0	
1360	J	EP	A1199		S	Tb	hel	? <i>Propora conferta</i>	L	0	
2081	J	EP	A1199		S	Tb	hel	<i>Heliolites</i>	L	0	
2449	J	EP	A1199		S	Tb	hel	?	M	0	
1179	J	EP	A1203		R	St	—	<i>Ecclimadictyon</i>	L	1	T

1181	J	EP	A1204		S	St	—	<i>Ecclimadictyon</i>	H	0	
1182	J	EP	A1204	11	S	St	—	? <i>Pachystylostroma</i>	D	0	
1183	J	EP	A1204		S	St	—	? <i>Ecclimadictyon</i>	H	0	
1065	J	EP	A1204a		S	St	—	<i>Ecclimadictyon</i>	L	1	T
1066	J	EP	A1204a		S	St	—	<i>Forolinia</i>	D	1	T
1067	J	EP	A1223	1	S	St	—	<i>Ecclimadictyon</i>	L	0	
1098	J	EP	A1241b		S	St	—	<i>Ecclimadictyon</i>	L	0	
1195	J	EP	A1241b		S	St	—	<i>Ecclimadictyon</i>	D	2	T
1196	J	EP	A1241b		S	St	—	<i>Ecclimadictyon</i>	L	1	T
1197	J	EP	A1241b		S	St	—	<i>Ecclimadictyon</i>	L	0	
1198	J	EP	A1241b		S	St	—	<i>Ecclimadictyon</i>	D	0	
1199	J	EP	A1241b		S	St	—	<i>Clathrodictyon</i>	L	0	
1200	J	EP	A1241b		S	St	—	<i>Clathrodictyon</i>	L	1	T
1201	J	EP	A1241b		S	St	—	<i>Ecclimadictyon</i>	D	0	
1202	J	EP	A1241b		S	St	—	? <i>Ecclimadictyon</i>	T	0	
851	J	EP	A1241b		S	Tb	hel	<i>Propora conferta</i>	T	0	
852	J	EP	A1241b		S	Tb	hel	? <i>Propora conferta</i>	D	1	T
853	J	EP	A1241b		S	Tb	hel	? <i>Propora conferta</i>	L	2	T
1203	J	EP	A1241b		S	Tb	hel	<i>Pycnolithus</i>	T	1	T
1170	J	EP	A1272		S	St	—	<i>Ecclimadictyon</i>	H	1	T
1171	J	EP	A1272		S	St	—	<i>Ecclimadictyon</i>	T	0	
1184	J	EP	A1275		R	St	—	? <i>Pachystylostroma</i>	T	0	
1186	J	EP	A1275	8	R	St	—	<i>Clathrodictyon</i>	T	0	
1187	J	EP	A1275		R	St	—	<i>Ecclimadictyon</i>	H	0	
1189	J	EP	A1275	7	R	St	—	?	D	0	
1030	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	D	0	
2405	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	D	0	
2406	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	L	0	
2407	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	L	0	
2408	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	L	0	
2409	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	D	0	
2411	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	D	0	
2412	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	T	0	
2413	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	L	0	
2414	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	D	0	
2415	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	D	0	
2416	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	D	0	
2417	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	D	0	
2418	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	D	0	
2419	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	L	0	
2420	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	D	0	
2421	J	EP	A1275		R	Tb	fav	<i>Favosites</i>	D	1	T
2398	J	EP	A1275		R	Tb	hel	?	L	0	
2399	J	EP	A1275		R	Tb	hel	?	D	0	
2400	J	EP	A1275		R	Tb	hel	?	L	0	
2401	J	EP	A1275		R	Tb	hel	?	L	0	
2402	J	EP	A1275		R	Tb	hel	?	D	0	
2403	J	EP	A1275		R	Tb	hel	?	L	0	
2404	J	EP	A1275		R	Tb	hel	?	T	0	
2410	J	EP	A1275		R	Tb	hel	?	D	0	
2423	J	EP	A1275		R	Tb	hel	?	L	0	
2424	J	EP	A1275		R	Tb	hel	?	D	0	
2425	J	EP	A1275		R	Tb	hel	?	L	0	
2426	J	EP	A1275		R	Tb	hel	?	D	1	T
1185	J	EP	A1275	10	R	Tb	mul	<i>Multisolenia</i>	T	0	

2422	J	EP	A1275		R	Tb	mul	<i>Multisolenia</i>	L	0	
1188	J	EP	A1275d		R	St	—	<i>Ecclimadictyon</i>	H	0	
1193	J	EP	A1293	2	S	St	—	<i>Ecclimadictyon</i>	L	1	T
1194	J	EP	A1293	2	S	St	—	<i>Forolina</i>	L	1	T
1204	J	EP	A1293	5	S	St	—	<i>Forolina</i>	D	0	
1205	J	EP	A1293		S	St	—	<i>Ecclimadictyon</i>	L	0	
1206	J	EP	A1293		S	St	—	<i>Ecclimadictyon</i>	D	0	
1207	J	EP	A1293		S	St	—	<i>Ecclimadictyon</i>	D	0	
2096	J	EP	A1293		M	St	—	<i>Ecclimadictyon</i>	H	0	
2097	J	EP	A1293		M	Tb	hel	<i>Pycnolithus</i>	D	0	
2379	J	EP	A1293		S	Tb	hel	<i>Heliolites</i>	D	1	T
2433	J	EP	A1307		S	Tb	fav	<i>Favosites</i>	D	1	T
2434	J	EP	A1307		S	Tb	fav	<i>Favosites</i>	L	0	
2435	J	EP	A1307		S	Tb	fav	<i>Favosites</i>	D	2	T
2436	J	EP	A1307		S	Tb	fav	<i>Favosites</i>	D	1	T
2437	J	EP	A1307		S	Tb	fav	<i>Favosites</i>	D	0	
2438	J	EP	A1307		S	Tb	fav	<i>Favosites</i>	D	0	
2439	J	EP	A1307		S	Tb	fav	<i>Favosites</i>	D	1	T
1483	J	EP	A1385	10	R	St	—	<i>Ecclimadictyon</i>	D	0	
1484	J	EP	A1385	1	R	St	—	<i>Forolina</i>	L	0	
1486	J	EP	A1385	8	R	Tb	fav	<i>Paleofavosites</i>	D	1	T
1487	J	EP	A1385	3	R	Tb	fav	<i>Paleofavosites</i>	D	1	T
1479	J	EP	A1385		R	Tb	mul	<i>Multisolenia</i>	L	0	
1480	J	EP	A1385	11	R	Tb	mul	<i>Multisolenia</i>	L	1	T
1481	J	EP	A1385	7	R	Tb	mul	<i>Multisolenia</i>	T	0	
1482	J	EP	A1385		R	Tb	mul	<i>Multisolenia</i>	T	0	
1485	J	EP	A1385	22	R	Tb	mul	<i>Multisolenia</i>	L	0	
1488	J	EP	A1385	2	R	Tb	mul	<i>Multisolenia</i>	L	0	
996	J	EP	A1386		R	St	—	?	L	0	
997	J	EP	A1386		R	St	—	?	L	1	T
998	J	EP	A1386		R	St	—	? <i>Densastroma</i>	T	0	
999	J	EP	A1386		R	St	—	? <i>Densastroma</i>	D	0	
1000	J	EP	A1386		R	St	—	?	L	0	
1001	J	EP	A1386		R	St	—	?	L	1	T
993	J	EP	A1386		R	Tb	mul	<i>Multisolenia</i>	T	0	
994	J	EP	A1386		R	Tb	mul	<i>Multisolenia</i>	L	0	
995	J	EP	A1386		R	Tb	mul	<i>Multisolenia</i>	L	0	
1002	J	EP	A1386		R	Tb	mul	<i>Multisolenia</i>	D	0	
987	J	EP	A1387		R	St	—	?	T	0	
988	J	EP	A1387		R	St	—	? <i>Densastroma</i>	L	0	
2395	J	EP	A197-12		S	St	—	?	L	1	T
2396	J	EP	A322-3		R	St	—	<i>Clathrodictyon</i>	D	1	T
2397	J	EP	A322-3		R	St	—	<i>Clathrodictyon</i>	D	0	
1169	J	EP	A702		M	St	—	? <i>Ecclimadictyon</i>	H	2	T
2450	J	EP	A702		M	Tb	fav	<i>Favosites</i>	L	0	
1177	J	EP	A703		R	St	—	<i>Clathrodictyon</i>	D	0	
1178	J	EP	A703		R	St	—	<i>Clathrodictyon</i>	D	0	
2378	J	EP	A703	24	R	St	—	<i>Clathrodictyon</i>	D	0	
2089	J	EP	A703		R	Tb	fav	<i>Favosites</i>	D	0	
2090	J	EP	A703	27	R	Tb	fav	<i>Favosites</i>	T	0	
2091	J	EP	A703	20	R	Tb	fav	<i>Favosites</i>	T	0	
2092	J	EP	A703	11	R	Tb	fav	<i>Favosites</i>	T	0	
2094	J	EP	A703	24	R	Tb	fav	<i>Favosites</i>	T	0	
2440	J	EP	A735	6	R	Tb	fav	<i>Favosites</i>	D	0	
2441	J	EP	A735	22	R	Tb	fav	<i>Favosites</i>	D	0	

2442	J	EP	A735	8	R	Tb	fav	<i>Favosites</i>	L	0	
2451	J	EP	A735		R	Tb	fav	<i>Favosites</i>	L	0	
2452	J	EP	A735	12	R	Tb	fav	<i>Favosites</i>	L	0	
2453	J	EP	A735	11	R	Tb	fav	<i>Favosites</i>	D	0	
2454	J	EP	A735	4	R	Tb	fav	<i>Favosites</i>	L	0	
2455	J	EP	A735	6	R	Tb	fav	<i>Favosites</i>	L	0	
1172	J	EP	A863		R	St	—	? <i>Ecclimadictyon</i>	L	0	
1173	J	EP	A863		R	St	—	? <i>Ecclimadictyon</i>	T	0	
1174	J	EP	A863		R	St	—	<i>Clathrodictyon</i>	T	0	
2366	J	EP	A863		R	St	—	<i>Clathrodictyon</i>	D	0	
2367	J	EP	A863		R	St	—	<i>Ecclimadictyon</i>	L	0	
2368	J	EP	A863		R	St	—	<i>Ecclimadictyon</i>	D	0	
2371	J	EP	A863		R	St	—	<i>Ecclimadictyon</i>	L	0	
2372	J	EP	A863		R	St	—	<i>Ecclimadictyon</i>	D	0	
2389	J	EP	A863		R	St	—	<i>Ecclimadictyon</i>	D	1	T
1176	J	EP	A863		R	Tb	fav	<i>Paleofavosites</i>	D	0	
2363	J	EP	A863		R	Tb	fav	<i>Favosites</i>	D	0	
2383	J	EP	A863		R	Tb	fav	<i>Favosites</i>	S	1	T
2384	J	EP	A863		R	Tb	fav	<i>Favosites</i>	L	0	
2385	J	EP	A863		R	Tb	fav	<i>Favosites</i>	S	0	
2386	J	EP	A863		R	Tb	fav	<i>Favosites</i>	D	0	
2387	J	EP	A863		R	Tb	fav	<i>Favosites</i>	M	0	
2388	J	EP	A863		R	Tb	fav	<i>Favosites</i>	L	0	
2391	J	EP	A863		R	Tb	fav	<i>Favosites</i>	D	0	
2392	J	EP	A863		R	Tb	fav	<i>Favosites</i>	D	1	T
2393	J	EP	A863		R	Tb	fav	<i>Favosites</i>	L	0	
2394	J	EP	A863		R	Tb	fav	<i>Favosites</i>	S	0	
1175	J	EP	A863		R	Tb	hel	<i>Propora conferta</i>	L	0	
2088	J	EP	A863		R	Tb	hel	<i>Heliolites</i>	L	0	
2359	J	EP	A863		R	Tb	hel	?	L	0	
2360	J	EP	A863		R	Tb	hel	?	L	1	T
2364	J	EP	A863		R	Tb	hel	?	L	0	
2365	J	EP	A863		R	Tb	hel	?	T	0	
2373	J	EP	A863		R	Tb	hel	?	D	0	
2374	J	EP	A863		R	Tb	hel	?	L	0	
2375	J	EP	A863		R	Tb	hel	?	L	0	
2376	J	EP	A863		R	Tb	hel	?	L	1	T
2377	J	EP	A863		R	Tb	hel	?	L	1	T
2390	J	EP	A863		R	Tb	hel	?	L	0	
2361	J	EP	A863		R	Tb	mul	<i>Multisolenia</i>	L	1	T
2362	J	EP	A863		R	Tb	mul	<i>Multisolenia</i>	L	0	
2369	J	EP	A863		R	Tb	mul	<i>Multisolenia</i>	L	0	
2370	J	EP	A863		R	Tb	mul	<i>Multisolenia</i>	L	0	
1168	J	EP	A930		R	St	—	<i>Clathrodictyon</i>	L	0	
2042	J	EP	A934		M	Tb	fav	<i>Favosites</i>	D	0	
2043	J	EP	A934		M	Tb	fav	<i>Favosites</i>	D	0	
2044	J	EP	A934		M	Tb	fav	<i>Favosites</i>	D	0	
2045	J	EP	A934		M	Tb	fav	<i>Favosites</i>	D	0	
2046	J	EP	A934		M	Tb	fav	<i>Favosites</i>	D	0	
2047	J	EP	A934		M	Tb	fav	<i>Favosites</i>	D	1	T
2048	J	EP	A934		M	Tb	fav	<i>Favosites</i>	D	1	T
2049	J	EP	A934		M	Tb	fav	<i>Favosites</i>	D	0	
2050	J	EP	A934		M	Tb	fav	<i>Favosites</i>	D	0	
2051	J	EP	A934		M	Tb	fav	<i>Favosites</i>	L	0	
2052	J	EP	A934		M	Tb	fav	<i>Favosites</i>	D	0	

2053	J	EP	A934		M	Tb	fav	<i>Favosites</i>	D	0	
1062	J	EP	A961		S	St	—	<i>Clathrodictyon</i>	D	1	T
1063	J	EP	A961		S	St	—	<i>Clathrodictyon</i>	L	0	
1057	J	EP	A967b		S	St	—	<i>Clathrodictyon</i>	D	0	
1058	J	EP	A967b		S	St	—	<i>Clathrodictyon</i>	L	0	
1059	J	EP	A967b		S	St	—	<i>Clathrodictyon</i>	D	1	T
890	J	EP	A967b		M	Tb	fav	<i>Favosites</i>	D	0	
891	J	EP	A967b		M	Tb	fav	<i>Favosites</i>	S	1	T
889	J	EP	A967b		M	Tb	hel	<i>Propora conferta</i>	H	0	
1032	J	G	A1035		S	Tb	fav	<i>Favosites</i>	D	1	T
660	J	G	A106		M	St	—	<i>Clathrodictyon</i>	D	2	T
1014	J	G	A1109c	2	M	St	—	<i>Clathrodictyon</i>	D	2	T, P, K, L
1120	J	G	A1109c	1	M	St	—	<i>Clathrodictyon</i>	D	2	T
674	J	G	A1121b		M	St	—	<i>Clathrodictyon</i>	D	1	T
675	J	G	A1121b		M	St	—	<i>Ecclimadictyon</i>	D	1	T
2506	J	G	A1149		S	Tb	fav	<i>Favosites</i>	L	0	
673	J	G	A1151		M	St	—	<i>Clathrodictyon</i>	T	3	T
1235	J	G	A1151		M	St	—	<i>Clathrodictyon</i>	D	3	T
670	J	G	A1164		M	St	—	<i>Clathrodictyon</i>	L	5	T
1146	J	G	A1164		M	St	—	? <i>Pachystroma</i>	D	3	T, P
665	J	G	A1164a		M	St	—	<i>Clathrodictyon</i>	D	3	T, L
667	J	G	A1164a	1	M	St	—	<i>Clathrodictyon</i>	D	3	T, L
668	J	G	A1164a	2	M	St	—	<i>Clathrodictyon</i>	L	1	T
669	J	G	A1164a	2	M	St	—	<i>Ecclimadictyon</i>	D	1	T
666	J	G	A1164a	1	M	Tb	alv	? <i>Alveolites</i>	L	3	T
662	J	G	A1164b		M	St	—	<i>Clathrodictyon</i>	D	5	T, K, L
661	J	G	A1164b		M	Tb	alv	? <i>Alveolites</i>	L	5	T
652	J	G	A1179		M	St	—	<i>Clathrodictyon</i>	D	5	T, P, L
1020	J	G	A1179		M	St	—	<i>Clathrodictyon</i>	L	4	T, L
1022	J	G	A1179	1	M	St	—	<i>Clathrodictyon</i>	D	2	T, K, L
1021	J	G	A1179		M	Tb	hel	<i>Pycnolithus</i>	L	2	T, L
2541	J	G	A1182		S	Tb	fav	<i>Favosites</i>	D	1	T
1243	J	G	A1184		M	St	—	<i>Clathrodictyon</i>	L	3	T, P
2498	J	G	A1187		M	Tb	fav	<i>Favosites</i>	D	0	
1238	J	G	A1188		M	St	—	<i>Clathrodictyon</i>	D	3	T
1239	J	G	A1188		M	St	—	<i>Clathrodictyon</i>	D	2	T
2473	J	G	A1188		M	St	—	<i>Clathrodictyon</i>	D	2	T
2474	J	G	A1188		M	Tb	hel	? <i>Propora</i>	D	2	T, K, L
1018	J	G	A1188a		M	St	—	<i>Clathrodictyon</i>	H	5	T, P, L
1124	J	G	A1188b		M	St	—	<i>Ecclimadictyon</i>	D	4	T, L
1121	J	G	A1188c		M	St	—	<i>Forolinia</i>	D	4	T
1122	J	G	A1188c		M	St	—	<i>Clathrodictyon</i>	D	2	T, K, L
1125	J	G	A1188c		M	St	—	<i>Clathrodictyon</i>	D	2	T
2471	J	G	A1189		M	St	—	<i>Clathrodictyon</i>	H	1	T
2472	J	G	A1189		M	Tb	fav	<i>Favosites</i>	D	0	
1128	J	G	A1189a		M	St	—	<i>Clathrodictyon</i>	D	5	T, P, L
1129	J	G	A1189a		M	St	—	<i>Ecclimadictyon</i>	D	4	T
1126	J	G	A1189b		M	St	—	<i>Clathrodictyon</i>	D	4	T, K, L
1127	J	G	A1189d		M	St	—	<i>Clathrodictyon</i>	D	5	T, P, L
2542	J	G	A12		S	Tb	fav	<i>Favosites</i>	L	1	T
1230	J	G	A1202		S	St	—	<i>Clathrodictyon</i>	D	1	T
1219	J	G	A1211		M	St	—	<i>Clathrodictyon</i>	D	5	T, P
1222	J	G	A1273		S	St	—	<i>Clathrodictyon</i>	L	0	
2519	J	G	A1287a		M	Tb	alv	? <i>Subalveolites</i>	L	3	T
2466	J	G	A1287a		M	Tb	fav	<i>Favosites</i>	D	1	T

1234	J	G	A1287a		M	Tb	hel	<i>Pycnolithus</i>	D	5	T
1241	J	G	A1287c		S	St	—	<i>Clathrodictyon</i>	L	1	T
1242	J	G	A1287c		S	St	—	<i>Clathrodictyon</i>	D	5	T
2518	J	G	A1287c		S	St	—	<i>Clathrodictyon</i>	L	1	T
1240	J	G	A1287c		S	Tb	hel	<i>Pycnolithus</i>	D	4	T
2515	J	G	A1287c		S	Tb	hel	<i>Acidolites</i>	L	1	T
2516	J	G	A1287c		S	Tb	hel	<i>Acidolites</i>	L	0	
2517	J	G	A1287c		S	Tb	hel	?	L	0	
2427	J	G	A1288c		M	Tb	alv	? <i>Subaiveolites</i>	L	1	T
1009	J	G	A13		M	Tb	fav	<i>Favosites</i>	D	1	T
1130	J	G	A1306c		M	St	—	<i>Forolinia</i>	D	3	T
1131	J	G	A1306c		M	St	—	<i>Clathrodictyon</i>	D	1	T, L
1221	J	G	A1306c		M	St	—	<i>Clathrodictyon</i>	D	3	T
1231	J	G	A1306d		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1232	J	G	A1306d		M	St	—	<i>Clathrodictyon</i>	D	2	T
1027	J	G	A1380		M	St	—	<i>Clathrodictyon</i>	H	3	T
968	J	G	A1380a		M	St	—	<i>Clathrodictyon</i>	D	2	T
969	J	G	A1380a		M	St	—	<i>Clathrodictyon</i>	D	2	T
970	J	G	A1380a		M	St	—	<i>Clathrodictyon</i>	D	1	T
971	J	G	A1380a		M	St	—	<i>Clathrodictyon</i>	L	1	T
972	J	G	A1380a		M	St	—	<i>Clathrodictyon</i>	D	1	T
654	J	G	A1391		M	St	—	<i>Clathrodictyon</i>	D	5	T, L
656	J	G	A1391		M	St	—	<i>Clathrodictyon</i>	D	5	T, L
657	J	G	A1391		M	St	—	<i>Clathrodictyon</i>	D	4	T, L
659	J	G	A1391		M	St	—	<i>Ecclimadictyon</i>	D	3	T, L
1047	J	G	A1391		M	St	—	<i>Clathrodictyon</i>	D	2	T, K, L
655	J	G	A1391		M	Tb	hel	<i>Pycnolithus</i>	T	3	T
658	J	G	A1391		M	Tb	hel	<i>Pycnolithus</i>	L	3	T
1137	J	G	A194		S	St	—	? <i>Ecclimadictyon</i>	L	0	
1138	J	G	A194		S	St	—	? <i>Ecclimadictyon</i>	D	1	T
1139	J	G	A194		S	St	—	<i>Clathrodictyon</i>	L	1	T
1140	J	G	A194		S	St	—	? <i>Ecclimadictyon</i>	L	2	T
1141	J	G	A194		S	St	—	? <i>Ecclimadictyon</i>	L	1	T
1142	J	G	A194		S	St	—	<i>Clathrodictyon</i>	D	2	T
1143	J	G	A194		S	St	—	<i>Clathrodictyon</i>	D	1	T
1144	J	G	A194		S	St	—	<i>Clathrodictyon</i>	D	1	T
2505	J	G	A194		S	Tb	fav	<i>Favosites</i>	L	1	T
677	J	G	A195		M	St	—	<i>Clathrodictyon</i>	D	2	T
1123	J	G	A195		M	St	—	<i>Ecclimadictyon</i>	H	1	T
2460	J	G	A195		M	Tb	fav	<i>Favosites</i>	L	0	
2461	J	G	A195		M	Tb	fav	<i>Paleofavosites</i>	L	0	
2462	J	G	A195		M	Tb	fav	<i>Favosites</i>	D	0	
2463	J	G	A195		M	Tb	fav	<i>Favosites</i>	L	0	
2464	J	G	A195		M	Tb	fav	<i>Paleofavosites</i>	D	2	T
2465	J	G	A195		M	Tb	fav	<i>Favosites</i>	L	0	
2508	J	G	A222		M	Tb	fav	<i>Favosites</i>	L	0	
2509	J	G	A222		M	Tb	fav	<i>Favosites</i>	L	0	
1133	J	G	A410		M	St	—	<i>Ecclimadictyon</i>	H	2	T, L
2510	J	G	A511		S	Tb	fav	<i>Favosites</i>	L	0	
2511	J	G	A511		S	Tb	fav	<i>Favosites</i>	L	0	
1209	J	G	A513		M	St	—	<i>Clathrodictyon</i>	D	1	T
1218	J	G	A513		M	St	—	<i>Clathrodictyon</i>	H	3	T, L
2494	J	G	A513		M	Tb	fav	<i>Favosites</i>	D	1	T
2530	J	G	A566		M	Tb	fav	<i>Favosites</i>	L	0	
2531	J	G	A566		M	Tb	fav	<i>Favosites</i>	L	0	

2532	J	G	A566		M	Tb	fav	<i>Favosites</i>	D	0	
2533	J	G	A566		M	Tb	fav	<i>Favosites</i>	D	1	T
2534	J	G	A566	13	M	Tb	fav	<i>Favosites</i>	D	1	T
2535	J	G	A566		M	Tb	fav	<i>Favosites</i>	L	1	T
2536	J	G	A566		M	Tb	fav	<i>Favosites</i>	H	0	
2537	J	G	A566		M	Tb	fav	<i>Favosites</i>	D	1	T
2538	J	G	A566		M	Tb	fav	<i>Favosites</i>	L	0	
2457	J	G	A596		M	Tb	fav	<i>Favosites</i>	D	0	
2458	J	G	A596		M	Tb	fav	<i>Favosites</i>	D	0	
140	J	G	A597		M	Tb	fav	? <i>Favosites</i>	L	1	T
141	J	G	A597		M	Tb	fav	<i>Favosites</i>	D	0	
142	J	G	A597		M	Tb	fav	<i>Favosites</i>	L	0	
2529	J	G	A597		M	Tb	fav	<i>Favosites</i>	L	0	
1236	J	G	A597a	2	M	St	—	<i>Ecclimadictyon</i>	D	1	T
1237	J	G	A597a	1	M	St	—	<i>Ecclimadictyon</i>	L	2	T
2470	J	G	A598		M	Tb	fav	<i>Favosites</i>	L	0	
2459	J	G	A66		M	Tb	fav	<i>Favosites</i>	D	0	
1212	J	G	A700		S	St	—	<i>Clathrodiclyon</i>	D	0	
1226	J	G	A701		M	St	—	<i>Ecclimadictyon</i>	L	0	
2504	J	G	A701		M	Tb	hel	?	D	1	T
1223	J	G	A707		S	St	—	?	D	1	T
1224	J	G	A707		S	St	—	?	L	3	T
1225	J	G	A707		S	St	—	<i>Clathrodiclyon</i>	L	1	T
2520	J	G	A708		M	Tb	fav	<i>Favosites</i>	L	0	
2549	J	G	A709		M	Tb	fav	<i>Favosites</i>	D	0	
2550	J	G	A709		M	Tb	fav	<i>Favosites</i>	D	1	T
2546	J	G	A710		M	Tb	fav	<i>Favosites</i>	L	1	T
2547	J	G	A710		M	Tb	fav	<i>Favosites</i>	L	0	
2524	J	G	A714		S	St	—	<i>Clathrodiclyon</i>	D	1	T
2521	J	G	A714		S	Tb	hel	?	L	0	
2522	J	G	A714		S	Tb	hel	?	D	0	
2523	J	G	A714		S	Tb	hel	?	L	0	
676	J	G	A733		M	St	—	<i>Ecclimadictyon</i>	D	1	T
2551	J	G	A733		M	Tb	fav	<i>Favosites</i>	D	0	
672	J	G	A734		M	St	—	<i>Clathrodiclyon</i>	H	3	T, K, L
2525	J	G	A734		M	St	—	<i>Clathrodiclyon</i>	D	0	
2483	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2484	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2485	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2486	J	G	A734		M	Tb	fav	<i>Favosites</i>	L	0	
2487	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2488	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2489	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2490	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2491	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2492	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2493	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2526	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2527	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	1	T
2528	J	G	A734		M	Tb	fav	<i>Favosites</i>	D	0	
2482	J	G	A734		M	Tb	hel	?	L	2	T
2499	J	G	A745		M	Tb	fav	<i>Favosites</i>	D	0	
2500	J	G	A745		M	Tb	fav	<i>Favosites</i>	D	0	
2501	J	G	A745		M	Tb	fav	<i>Favosites</i>	L	0	
2502	J	G	A745		M	Tb	fav	<i>Favosites</i>	D	1	T

2503	J	G	A745		M	Tb	fav	<i>Favosites</i>	D	0	
649	J	G	A759		M	St	—	<i>Clathrodictyon</i>	L	4	T, P
650	J	G	A759		M	St	—	<i>Clathrodictyon</i>	L	1	T, K, L
651	J	G	A759		M	St	—	<i>Clathrodictyon</i>	L	1	T
1214	J	G	A759		M	St	—	<i>Clathrodictyon</i>	H	2	T
1215	J	G	A759		M	St	—	<i>Clathrodictyon</i>	L	4	T
1216	J	G	A759		M	St	—	<i>Clathrodictyon</i>	D	2	T
1217	J	G	A759	1	M	St	—	<i>Clathrodictyon</i>	H	5	T
2495	J	G	A759		M	Tb	fav	<i>Favosites</i>	D	1	T
2496	J	G	A759		M	Tb	hel	<i>Heliolites</i>	L	0	
2497	J	G	A759		M	Tb	hel	?	D	3	T
1229	J	G	A760	2	M	St	—	<i>Ecclimadictyon</i>	H	1	T
1228	J	G	A760a	1	M	St	—	<i>Clathrodictyon</i>	H	2	T, L
1227	J	G	A760a	1	M	Tb	hel	<i>Pycnolithus</i>	D	3	T, L
2479	J	G	A768		M	St	—	<i>Clathrodictyon</i>	D	2	T
2481	J	G	A768		M	Tb	fav	<i>Favosites</i>	S	0	
2478	J	G	A768		M	Tb	hel	?	D	5	T
2480	J	G	A768		M	Tb	hel	?	D	0	
1220	J	G	A769		M	St	—	<i>Clathrodictyon</i>	H	2	T, K, L
2507	J	G	A808		M	Tb	fav	<i>Favosites</i>	L	0	
1233	J	G	A808a		M	St	—	<i>Ecclimadictyon</i>	D	1	T
663	J	G	A835	2	M	St	—	<i>Clathrodictyon</i>	D	5	T, L
664	J	G	A835	2	M	St	—	<i>Ecclimadictyon</i>	D	2	T
671	J	G	A835		M	St	—	<i>Clathrodictyon</i>	D	1	T
1132	J	G	A835	1	M	St	—	<i>Clathrodictyon</i>	D	5	T, L
653	J	G	A846		M	St	—	<i>Clathrodictyon</i>	D	2	T, K, L
678	J	G	A846		M	St	—	<i>Clathrodictyon</i>	D	3	T, L
679	J	G	A846		M	St	—	<i>Clathrodictyon</i>	H	5	T, L
2475	J	G	A846		M	Tb	fav	<i>Favosites</i>	D	0	
2476	J	G	A846		M	Tb	hel	?	D	1	T
1136	J	G	A846b		M	St	—	<i>Clathrodictyon</i>	L	2	T
1135	J	G	A846c		M	St	—	<i>Clathrodictyon</i>	D	1	T, K, L
1208	J	G	A849		M	St	—	<i>Clathrodictyon</i>	D	1	T
2512	J	G	A887		M	Tb	fav	<i>Favosites</i>	D	0	
2513	J	G	A887		M	Tb	fav	<i>Favosites</i>	S	0	
2514	J	G	A887		M	Tb	fav	<i>Favosites</i>	D	0	
1210	J	G	A888		M	St	—	<i>Clathrodictyon</i>	D	1	T
1211	J	G	A888		M	St	—	<i>Clathrodictyon</i>	D	0	
2467	J	G	A889		M	Tb	fav	<i>Favosites</i>	L	0	
2468	J	G	A889		M	Tb	fav	<i>Favosites</i>	D	0	
2469	J	G	A889		M	Tb	fav	<i>Favosites</i>	S	0	
1180	J	G	A890		M	St	—	<i>Ecclimadictyon</i>	D	3	T, P, L
1213	J	G	A890		M	St	—	<i>Clathrodictyon</i>	D	3	T
2544	J	G	A890		M	Tb	alv	?Subalveolites	S	2	T
2477	J	G	A890		M	Tb	fav	<i>Favosites</i>	L	0	
2543	J	G	A890		M	Tb	fav	<i>Favosites</i>	L	0	
2430	J	G	A916		M	St	—	<i>Clathrodictyon</i>	D	1	T
2431	J	G	A916		M	Tb	hel	<i>Heliolites</i>	L	1	T
884	J	G	A917a		S	Tb	fav	<i>Favosites</i>	D	1	T
886	J	G	A917a		S	Tb	fav	<i>Favosites</i>	D	0	
888	J	G	A917a		S	Tb	fav	<i>Favosites</i>	L	1	T
885	J	G	A917a		S	Tb	hel	<i>Propora conferta</i>	D	0	
887	J	G	A917a		S	Tb	hel	<i>Propora conferta</i>	D	1	T
2540	J	G	A950a		M	St	—	<i>Clathrodictyon</i>	D	4	T
2539	J	G	A950a		M	Tb	fav	<i>Favosites</i>	L	0	

2548	J	G	C663		S	Tb	fav	<i>Favosites</i>	D	1	T
68	GR	M	A224		M	Tb	fav	<i>Favosites</i>	D	1	T
1272	GR	M	A226		M	St	—	<i>Ecclimadictyon</i>	L	0	
1273	GR	M	A226		M	St	—	<i>Ecclimadictyon</i>	D	0	
70	GR	M	A226		M	Tb	fav	? <i>Favosites</i>	L	0	
71	GR	M	A226		M	Tb	fav	? <i>Favosites</i>	H	0	
72	GR	M	A226		M	Tb	fav	? <i>Favosites</i>	D	0	
73	GR	M	A226		M	Tb	fav	? <i>Favosites</i>	S	0	
74	GR	M	A226		M	Tb	fav	? <i>Favosites</i>	L	0	
75	GR	M	A226		M	Tb	fav	? <i>Favosites</i>	D	0	
76	GR	M	A226		M	Tb	fav	? <i>Favosites</i>	S	1	T
77	GR	M	A226		M	Tb	fav	? <i>Favosites</i>	L	1	T
78	GR	M	A226		M	Tb	fav	? <i>Favosites</i>	D	1	T
79	GR	M	A226	2	M	Tb	fav	? <i>Favosites</i>	D	2	T
1262	GR	M	A230		S	St	—	<i>Clathrodiction</i>	D	1	T
149	GR	M	A232		M	Tb	fav	<i>Favosites</i>	L	1	T
150	GR	M	A232		M	Tb	fav	<i>Favosites</i>	T	0	
151	GR	M	A232		M	Tb	fav	<i>Favosites</i>	L	0	
155	GR	M	A284		S	Tb	fav	? <i>Favosites</i>	S	0	
156	GR	M	A284		S	Tb	fav	? <i>Favosites</i>	L	0	
157	GR	M	A284		S	Tb	fav	? <i>Favosites</i>	S	0	
158	GR	M	A284		S	Tb	fav	? <i>Favosites</i>	L	0	
159	GR	M	A284		S	Tb	fav	? <i>Favosites</i>	L	0	
160	GR	M	A284		S	Tb	fav	? <i>Favosites</i>	L	0	
161	GR	M	A284		S	Tb	fav	? <i>Favosites</i>	L	1	T
162	GR	M	A284		S	Tb	fav	? <i>Favosites</i>	L	0	
165	GR	M	A284		S	Tb	fav	? <i>Favosites</i>	D	0	
1263	GR	M	A284		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
153	GR	M	A284		S	Tb	hel	<i>Propora conferta</i>	S	0	
154	GR	M	A284		S	Tb	hel	<i>Propora conferta</i>	L	0	
163	GR	M	A284		S	Tb	hel	?	D	0	
164	GR	M	A284		S	Tb	hel	?	D	0	
1264	GR	M	A284		M	Tb	mul	<i>Multisolenia</i>	D	0	
145	GR	M	A288		S	Tb	hel	<i>Propora conferta</i>	D	1	T
146	GR	M	A288		S	Tb	hel	<i>Propora conferta</i>	D	1	T
147	GR	M	A288		S	Tb	hel	<i>Propora conferta</i>	H	1	T
148	GR	M	A288		S	Tb	hel	<i>Propora conferta</i>	D	1	T
1270	GR	M	A288a		S	St	—	<i>Ecclimadictyon</i>	D	0	
1271	GR	M	A288b		S	St	—	<i>Clathrodiction</i>	M	0	
84	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	1	T
85	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	1	T
86	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	1	T
87	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	1	T
88	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	1	T
89	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	1	T
90	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	1	T
91	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
92	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
93	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
94	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
95	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
96	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
97	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
98	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
99	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	

100	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
101	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
102	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
103	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
104	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
105	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
106	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
107	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
108	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
109	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
110	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
111	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
112	GR	M	A355		M	Tb	fav	<i>Favosites</i>	S	0	
113	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
114	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
115	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
116	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
117	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
118	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
119	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
120	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
121	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
122	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
123	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
124	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
125	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
126	GR	M	A355		M	Tb	fav	<i>Favosites</i>	D	0	
127	GR	M	A355		M	Tb	fav	<i>Favosites</i>	L	0	
1256	GR	M	A597b		M	St	—	<i>Forolinia</i>	D	1	T
1257	GR	M	A597b		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1258	GR	M	A597b		M	St	—	<i>Clathrodicton</i>	L	2	T
207	GR	M	A707		S	Tb	fav	<i>Favosites</i>	D	0	
208	GR	M	A707		S	Tb	fav	<i>Favosites</i>	D	0	
209	GR	M	A707		S	Tb	fav	<i>Favosites</i>	D	0	
210	GR	M	A707		S	Tb	fav	<i>Favosites</i>	D	0	
211	GR	M	A707		S	Tb	fav	<i>Favosites</i>	D	0	
212	GR	M	A707		S	Tb	fav	<i>Favosites</i>	D	1	T
213	GR	M	A707		S	Tb	fav	<i>Favosites</i>	L	1	T
214	GR	M	A707		S	Tb	fav	<i>Favosites</i>	L	1	T
215	GR	M	A707		S	Tb	fav	<i>Favosites</i>	L	1	T
216	GR	M	A707		S	Tb	fav	<i>Favosites</i>	D	1	T
217	GR	M	A707		S	Tb	fav	<i>Favosites</i>	L	1	T
143	GR	M	A715		M	Tb	fav	<i>Favosites</i>	D	0	
144	GR	M	A715		M	Tb	fav	? <i>Favosites</i>	L	0	
128	GR	M	A716		M	Tb	fav	<i>Favosites</i>	D	0	
129	GR	M	A716		M	Tb	fav	<i>Favosites</i>	D	0	
130	GR	M	A716		M	Tb	fav	<i>Favosites</i>	D	0	
131	GR	M	A716		M	Tb	fav	<i>Favosites</i>	D	0	
132	GR	M	A716		M	Tb	fav	<i>Favosites</i>	L	0	
133	GR	M	A716		M	Tb	fav	<i>Favosites</i>	L	0	
134	GR	M	A716		M	Tb	fav	<i>Favosites</i>	L	0	
135	GR	M	A716		M	Tb	fav	<i>Favosites</i>	L	0	
136	GR	M	A716		M	Tb	fav	<i>Favosites</i>	D	0	
137	GR	M	A716		M	Tb	fav	<i>Favosites</i>	D	0	
152	GR	M	A732		S	Tb	fav	? <i>Favosites</i>	L	0	

2432	GR	M	A771		S	St	—	<i>Clathrodictyon</i>	D	4	T
1269	GR	M	A808b		S	St	—	<i>Ecclimadictyon</i>	D	2	T
2545	GR	M	A899		S	Tb	fav	<i>Favosites</i>	L	0	
183	GR	M	C632		M	St	—	? <i>Clathrodictyon</i>	D	1	T
184	GR	M	C632		M	Tb	fav	? <i>Favosites</i>	L	0	
189	GR	S	A1358		S	St	—	? <i>Clathrodictyon</i>	H	1	T
190	GR	S	A1358		S	St	—	? <i>Clathrodictyon</i>	L	1	T
191	GR	S	A1358		S	St	—	? <i>Clathrodictyon</i>	L	0	
192	GR	S	A1358		S	St	—	? <i>Clathrodictyon</i>	L	1	T
218	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	D	1	T
219	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	T	0	
220	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	H	0	
221	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	D	1	T
222	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	D	1	T
223	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	D	2	T
224	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	D	1	T
225	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	D	0	
226	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	D	0	
227	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	D	0	
228	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	D	0	
229	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	H	0	
230	GR	S	A1358		S	St	—	? <i>Ecclimadictyon</i>	D	1	T
193	GR	S	A1358		S	Tb	fav	? <i>Favosites</i>	L	0	
194	GR	S	A1358		S	Tb	fav	? <i>Favosites</i>	S	0	
195	GR	S	A1358		S	Tb	fav	? <i>Favosites</i>	S	0	
196	GR	S	A1358		S	Tb	fav	? <i>Favosites</i>	L	1	T
231	GR	S	A1358		S	Tb	hel	<i>Propora conferta</i>	D	0	
83	GR	S	A23		S	St	—	<i>Clathrodictyon</i>	D	1	T
82	GR	S	A23		S	Tb	fav	? <i>Favosites</i>	D	0	
1260	GR	S	A239		M	St	—	<i>Clathrodictyon</i>	D	0	
81	GR	S	A37a		M	Tb	hel	<i>Propora conferta</i>	D	1	T
1259	GR	S	A746		M	St	—	<i>Clathrodictyon</i>	D	0	
1261	GR	S	A949		M	St	—	<i>Clathrodictyon</i>	D	1	T
66	GR	I	A726		S	Tb	fav	? <i>Favosites</i>	L	0	
67	GR	I	A726		S	Tb	hel	<i>Propora conferta</i>	S	0	
13	GR	Lt	A151		S	Tb	fav	<i>Favosites</i>	L	0	
139	GR	Lt	A505		S	Tb	fav	? <i>Favosites</i>	L	1	T
138	GR	Lt	A505		S	Tb	hel	<i>Propora conferta</i>	S	1	T
14	GR	Lt	A722		M	Tb	fav	<i>Favosites</i>	L	0	
15	GR	Lt	A722		M	Tb	fav	<i>Favosites</i>	D	0	
1038	GR	Lt	A752		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
1308	M		A1018a		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1309	M		A1018a		M	St	—	<i>Ecclimadictyon</i>	D	1	T
717	M		A1023		S	St	—	<i>Clathrodictyon</i>	D	1	T
1318	M		A1023		S	St	—	<i>Ecclimadictyon</i>	D	0	
1319	M		A1023		S	St	—	<i>Ecclimadictyon</i>	D	1	T
1320	M		A1023		S	St	—	<i>Ecclimadictyon</i>	D	2	T
1321	M		A1023		S	St	—	<i>Ecclimadictyon</i>	H	3	T
718	M		A1023		S	Tb	fav	? <i>Paleofavosites</i>	L	1	T
726	M		A1026		M	Tb	fav	<i>Paleofavosites</i>	D	0	
733	M		A1242		M	St	—	?	L	0	
1281	M		A1242	e	M	St	—	<i>Ecclimadictyon</i>	H	1	T
1282	M		A1242		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1283	M		A1242		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1285	M		A1242		M	St	—	<i>Ecclimadictyon</i>	D	1	T

1286	M		A1242		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1287	M		A1242		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1288	M		A1242		M	St	—	<i>Ecclimadictyon</i>	D	2	T
1289	M		A1242		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1290	M		A1242		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1291	M		A1242		M	St	—	<i>Ecclimadictyon</i>	D	2	T
1280	M		A1242	e	M	Tb	hel	<i>Propora conferta</i>	D	1	T
1284	M		A1242		M	Tb	hel	? <i>Propora conferta</i>	D	1	T
1298	M		A1242a		M	St	—	?	T	1	T
1297	M		A1242a		M	Tb	hel	? <i>Protrochiscolithus</i>	T	2	T
1296	M		A1242b		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1295	M		A1242c		M	St	—	<i>Ecclimadictyon</i>	L	1	T
1299	M		A1242d		M	St	—	<i>Ecclimadictyon</i>	H	0	
735	M		A1243		S	Tb	mul	<i>Multisolenia</i>	D	1	T
1300	M		A1329		S	St	—	<i>Forolinia</i>	D	1	T
1301	M		A1329		S	St	—	<i>Ecclimadictyon</i>	D	1	T
1302	M		A1329		S	St	—	<i>Ecclimadictyon</i>	H	1	T
1303	M		A1329		S	St	—	<i>Ecclimadictyon</i>	D	1	T
1304	M		A1329		S	St	—	<i>Ecclimadictyon</i>	H	1	T
1305	M		A1329		S	St	—	<i>Ecclimadictyon</i>	D	2	T
1306	M		A1329		S	St	—	<i>Ecclimadictyon</i>	H	1	T
1307	M		A1329		S	St	—	<i>Ecclimadictyon</i>	L	1	T
734	M		A1329		S	Tb	fav	<i>Favosites</i>	H	0	
1312	M		A1330b		S	St	—	<i>Ecclimadictyon</i>	M	1	T
592	M		A1342		M	St	—	?	L	1	T
593	M		A1342		M	St	—	?	L	1	T
595	M		A1342		M	St	—	<i>Ecclimadictyon</i>	S	1	T
596	M		A1342		M	St	—	<i>Ecclimadictyon</i>	D	1	T
599	M		A1342		M	St	—	?	L	0	
600	M		A1342		M	Tb	fav	?	D	1	T
594	M		A1342		M	Tb	hel	<i>Propora conferta</i>	H	0	
601	M		A1342		M	Tb	hel	<i>Propora conferta</i>	D	1	T
590	M		A1342		M	Tb	mul	? <i>Multisolenia</i>	L	0	
591	M		A1342		M	Tb	mul	? <i>Multisolenia</i>	S	1	T
597	M		A1342		M	Tb	mul	? <i>Multisolenia</i>	S	1	T
598	M		A1342		M	Tb	mul	? <i>Multisolenia</i>	D	1	T
1033	M		A1359a		M	Tb	fav	<i>Favosites</i>	L	0	
606	M		A1360		M	St	—	<i>Ecclimadictyon</i>	D	1	T
609	M		A1360		M	St	—	? <i>Amphipora</i>	S	1	T
716	M		A1360		M	St	—	? <i>Amphipora</i>	H	1	T
607	M		A1360		M	Tb	fav	<i>Paleofavosites</i>	D	2	T
608	M		A1360		M	Tb	fav	<i>Paleofavosites</i>	H	1	T
1016	M		A1360		M	Tb	fav	<i>Paleofavosites</i>	D	4	T
1017	M		A1360		M	Tb	fav	<i>Paleofavosites</i>	D	4	T
603	M		A1361		M	St	—	<i>Ecclimadictyon</i>	D	2	T
604	M		A1361		M	St	—	<i>Ecclimadictyon</i>	D	1	T
1015	M		A1361		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
605	M		A1361		M	Tb	hel	<i>Propora conferta</i>	T	2	T
1276	M		A150a		M	St	—	<i>Ecclimadictyon</i>	H	0	
703	M		A150a		M	Tb	fav	<i>Paleofavosites</i>	D	0	
705	M		A150a		M	Tb	fav	<i>Paleofavosites</i>	D	0	
706	M		A150a		M	Tb	fav	<i>Paleofavosites</i>	D	0	
707	M		A150a		M	Tb	fav	<i>Paleofavosites</i>	D	1	T, ?L
708	M		A150a		M	Tb	fav	<i>Paleofavosites</i>	D	0	
704	M		A150a		M	Tb	hel	<i>Propora conferta</i>	D	1	T

702	M	A150b	M	St	—	?Clathrodictyon	T	1	T
1266	M	A22	M	St	—	Ecclimadictyon	D	0	
1267	M	A22	M	St	—	Ecclimadictyon	D	1	T
1268	M	A22	M	St	—	Ecclimadictyon	D	1	T
721	M	A22	M	Tb	fav	?Mesofavosites	L	0	
722	M	A22	M	Tb	fav	?Paleofavosites	S	0	
723	M	A22	M	Tb	fav	?Paleofavosites	L	1	T
724	M	A22	M	Tb	fav	?Paleofavosites	S	0	
253	M	A240	M	Tb	fav	Paleofavosites	L	1	T
701	M	A317-5	M	Tb	hel	Propora conferta	T	0	
720	M	A356-4	M	Tb	fav	Paleofavosites	D	0	
973	M	A505	M	St	—	Ecclimadictyon	D	0	
3	M	A505	S	Tb	fav	?Favosites	T	1	T
4	M	A505	S	Tb	fav	?Favosites	D	1	T
8	M	A505	S	Tb	fav	?Favosites	T	0	
9	M	A505	S	Tb	fav	Favosites	D	0	
10	M	A505	S	Tb	fav	?Favosites	L	0	
739	M	A505	M	Tb	fav	Paleofavosites	D	0	
741	M	A505	M	Tb	fav	Paleofavosites	L	0	
743	M	A505	M	Tb	fav	Paleofavosites	D	0	
5	M	A505	S	Tb	hel	?	L	0	
7	M	A505	S	Tb	hel	Propora conferta	S	2	T
742	M	A505	M	Tb	hel	Propora conferta	D	0	
738	M	A505	M	Tb	mul	Multisolenia	L	1	T
740	M	A505	M	Tb	mul	Multisolenia	L	1	T
1313	M	A505b	M	St	—	Ecclimadictyon	D	1	T
1293	M	A505c	M	St	—	?Clavidictyon	D	0	
1310	M	A505c	1	S	St	Clavidictyon	M	0	
736	M	A505c	M	Tb	fav	Paleofavosites	D	0	
737	M	A505c	M	Tb	fav	Paleofavosites	L	0	
744	M	A505c	M	Tb	hel	Propora conferta	S	1	T
2	M	A505c	S	Tb	mul	?Multisolenia	L	1	T
11	M	A505g	M	Tb	fav	Favosites	D	0	
12	M	A505g	M	Tb	hel	Propora conferta	T	0	
728	M	A507	M	Tb	fav	?Paleofavosites	D	0	
729	M	A507	M	Tb	mul	Multisolenia	D	1	T
1292	M	A723	M	St	—	Ecclimadictyon	D	0	
730	M	A723	M	Tb	fav	Mesofavosites	D	1	T
731	M	A723	M	Tb	fav	Mesofavosites	D	1	T
732	M	A723	M	Tb	fav	Mesofavosites	D	0	
1265	M	A739	S	St	—	Clathrodictyon	D	0	
1311	M	A741	S	St	—	Ecclimadictyon	D	1	T
719	M	A741	S	Tb	fav	Paleofavosites	D	0	
1274	M	A761	M	St	—	Ecclimadictyon	L	0	
1275	M	A761	M	St	—	Ecclimadictyon	H	2	T
725	M	A761	M	Tb	fav	Paleofavosites	H	0	
1277	M	A841	M	St	—	?Clavidictyon	C	0	
1278	M	A841	M	St	—	?Clavidictyon	D	0	
1279	M	A841	M	Tb	fav	Paleofavosites	D	0	
767	M	A841	S	Tb	hel	Propora conferta	D	0	
768	M	A841	S	Tb	hel	Propora conferta	D	0	
765	M	A841	S	Tb	mul	Multisolenia	D	1	T
766	M	A841	S	Tb	mul	Multisolenia	D	0	
1294	M	A842	S	St	—	?Ecclimadictyon	L	0	
727	M	A883	M	Tb	fav	Paleofavosites	D	2	T

1330	B	Ch	A121	S	St	—	<i>Ecclimadictyon</i>	H	1	T
800	B	Ch	A121	S	Tb	fav	? <i>Paleofavosites</i>	L	0	
801	B	Ch	A121	S	Tb	fav	? <i>Paleofavosites</i>	L	0	
1337	B	Ch	A1232	S	St	—	<i>Ecclimadictyon</i>	L	1	T
1338	B	Ch	A1232	S	St	—	<i>Ecclimadictyon</i>	D	1	T
1325	B	Ch	A1244	S	St	—	<i>Ecclimadictyon</i>	D	0	
1326	B	Ch	A1244	S	St	—	<i>Ecclimadictyon</i>	D	0	
711	B	Ch	A1335	S	St	—	<i>Ecclimadictyon</i>	D	1	T
712	B	Ch	A1335	S	St	—	<i>Ecclimadictyon</i>	D	0	
715	B	Ch	A1335	S	St	—	<i>Ecclimadictyon</i>	D	1	T
710	B	Ch	A1335	S	Tb	fav	? <i>Favosites</i>	L	0	
713	B	Ch	A1335	S	Tb	fav	<i>Paleofavosites</i>	D	0	
714	B	Ch	A1335	S	Tb	fav	? <i>Paleofavosites</i>	H	0	
1347	B	Ch	A1336	S	St	—	<i>Ecclimadictyon</i>	D	1	T
1348	B	Ch	A1336	S	St	—	<i>Ecclimadictyon</i>	D	0	
1344	B	Ch	A1336	S	Tb	fav	<i>Paleofavosites</i>	D	0	
1345	B	Ch	A1336	S	Tb	fav	<i>Paleofavosites</i>	L	0	
1346	B	Ch	A1336	S	Tb	fav	<i>Paleofavosites</i>	H	0	
1349	B	Ch	A1336	S	Tb	fav	<i>Paleofavosites</i>	D	0	
1350	B	Ch	A1336	S	Tb	fav	<i>Paleofavosites</i>	H	0	
1351	B	Ch	A1336	S	Tb	fav	<i>Paleofavosites</i>	D	0	
1352	B	Ch	A1336	S	Tb	fav	<i>Paleofavosites</i>	D	0	
1049	B	Ch	A1337	M	St	—	<i>Ecclimadictyon</i>	D	0	
1354	B	Ch	A1337	M	St	—	<i>Ecclimadictyon</i>	L	1	T
1355	B	Ch	A1337	M	St	—	<i>Ecclimadictyon</i>	L	1	T
1356	B	Ch	A1337	M	St	—	<i>Ecclimadictyon</i>	D	0	
1358	B	Ch	A1337	M	St	—	? <i>Clavidictyon</i>	D	0	
1342	B	Ch	A1337	M	Tb	fav	<i>Paleofavosites</i>	L	0	
1343	B	Ch	A1337	M	Tb	fav	<i>Favosites</i>	D	1	T
1359	B	Ch	A1337	M	Tb	fav	<i>Paleofavosites</i>	D	0	
1353	B	Ch	A1337	M	Tb	mul	<i>Multisolenia</i>	D	0	
1357	B	Ch	A1337	M	Tb	mul	<i>Multisolenia</i>	D	0	
691	B	Ch	A1363	M	St	—	<i>Pachystylostroma</i>	T	0	
692	B	Ch	A1363	M	St	—	<i>Pachystylostroma</i>	T	0	
693	B	Ch	A1363	M	St	—	<i>Pachystylostroma</i>	T	0	
694	B	Ch	A1363	M	St	—	<i>Pachystylostroma</i>	T	0	
695	B	Ch	A1363	M	St	—	<i>Pachystylostroma</i>	T	0	
696	B	Ch	A1363	M	St	—	<i>Pachystylostroma</i>	T	0	
697	B	Ch	A1363	M	St	—	<i>Pachystylostroma</i>	T	0	
698	B	Ch	A1363	M	St	—	<i>Pachystylostroma</i>	T	0	
699	B	Ch	A1363	M	St	—	<i>Pachystylostroma</i>	T	0	
700	B	Ch	A1363	M	St	—	? <i>Clathrodictyon</i>	L	1	T
803	B	Ch	A1363	M	St	—	<i>Ecclimadictyon</i>	D	2	T
804	B	Ch	A1363	M	St	—	<i>Ecclimadictyon</i>	D	1	T
805	B	Ch	A1363	M	St	—	<i>Ecclimadictyon</i>	H	1	T
806	B	Ch	A1363	M	St	—	<i>Ecclimadictyon</i>	D	2	T
807	B	Ch	A1363	M	St	—	<i>Ecclimadictyon</i>	D	2	T
690	B	Ch	A1363	M	Tb	fav	<i>Paleofavosites</i>	S	3	T
709	B	Ch	A1396	S	Tb	fav	? <i>Favosites</i>	D	0	
689	B	Ch	A1396	S	Tb	hel	<i>Propora conferta</i>	D	1	T
791	B	Ch	A140	S	Tb	hel	<i>Propora conferta</i>	D	1	T
795	B	Ch	A148	S	Tb	hel	<i>Propora conferta</i>	D	0	
796	B	Ch	A148	S	Tb	hel	<i>Propora conferta</i>	D	0	
780	B	Ch	A24	S	Tb	fav	<i>Paleofavosites</i>	D	0	
1341	B	Ch	A289	S	St	—	<i>Ecclimadictyon</i>	D	0	

793	B	Ch	A289		S	Tb	fav	?Paleofavosites	L	0	
792	B	Ch	A289		S	Tb	hel	Propora conferta	D	0	
779	B	Ch	A291		S	St	—	?	D	0	
777	B	Ch	A291		S	Tb	fav	?Favosites	L	0	
778	B	Ch	A291		S	Tb	fav	?Favosites	L	0	
776	B	Ch	A291		S	Tb	hel	Propora conferta	S	0	
769	B	Ch	A293		S	St	—	Phaenopora	L	0	
802	B	Ch	A310		S	Tb	hel	Propora conferta	D	0	
1340	B	Ch	A421		S	St	—	Ecclimadictyon	D	1	T
770	B	Ch	A421		S	Tb	fav	?Paleofavosites	D	0	
1322	B	Ch	A422		S	St	—	Ecclimadictyon	D	0	
1324	B	Ch	A422		S	St	—	Ecclimadictyon	D	0	
771	B	Ch	A422		S	Tb	fav	?Paleofavosites	D	1	T
1323	B	Ch	A422		S	Tb	fav	Paleofavosites	D	0	
1314	B	Ch	A504		S	St	—	Ecclimadictyon	L	0	
1315	B	Ch	A504		S	St	—	Ecclimadictyon	L	0	
1316	B	Ch	A504		S	St	—	Ecclimadictyon	L	0	
1317	B	Ch	A504		S	St	—	Ecclimadictyon	S	1	T
6	B	Ch	A504		S	Tb	fav	Favosites	D	3	T
745	B	Ch	A504		S	Tb	fav	Favosites	D	0	
746	B	Ch	A504		S	Tb	fav	Favosites	D	0	
747	B	Ch	A504		S	Tb	fav	Paleofavosites	D	1	T
748	B	Ch	A504		S	Tb	fav	Paleofavosites	D	0	
749	B	Ch	A504		S	Tb	fav	Paleofavosites	D	0	
750	B	Ch	A504		S	Tb	fav	Paleofavosites	L	0	
751	B	Ch	A504		S	Tb	fav	Paleofavosites	D	0	
752	B	Ch	A504		S	Tb	fav	Paleofavosites	L	0	
753	B	Ch	A504		S	Tb	fav	Paleofavosites	L	0	
754	B	Ch	A504		S	Tb	fav	Paleofavosites	L	0	
755	B	Ch	A504		S	Tb	fav	Paleofavosites	D	1	T
756	B	Ch	A504		S	Tb	fav	?Paleofavosites	D	1	T
757	B	Ch	A504		S	Tb	fav	Paleofavosites	D	0	
758	B	Ch	A504		S	Tb	fav	Paleofavosites	D	0	
759	B	Ch	A504		S	Tb	fav	Paleofavosites	D	0	
760	B	Ch	A504		S	Tb	hel	Propora conferta	M	0	
761	B	Ch	A504		S	Tb	hel	Propora conferta	D	0	
762	B	Ch	A504		S	Tb	hel	Propora conferta	D	0	
763	B	Ch	A504		S	Tb	hel	Propora conferta	D	0	
764	B	Ch	A504		S	Tb	hel	Propora conferta	D	0	
974	B	Ch	A504	3	S	Tb	mul	Multisolenia	D	0	
975	B	Ch	A504	4	S	Tb	mul	Multisolenia	D	0	
976	B	Ch	A504		S	Tb	mul	Multisolenia	D	0	
977	B	Ch	A504		S	Tb	mul	Multisolenia	D	1	T
1331	B	Ch	A843	1	S	St	—	Ecclimadictyon	H	1	T
1332	B	Ch	A843		S	St	—	Ecclimadictyon	L	0	
1333	B	Ch	A843		S	St	—	Ecclimadictyon	H	0	
1334	B	Ch	A843		S	St	—	Ecclimadictyon	C	1	T
797	B	Ch	A843		S	Tb	fav	Paleofavosites	H	0	
1339	B	Ch	A844		S	St	—	Ecclimadictyon	D	2	T
798	B	Ch	A844		S	Tb	fav	Paleofavosites	D	2	T
799	B	Ch	A844		S	Tb	mul	Multisolenia	D	0	
772	B	Ch	A882		S	Tb	fav	?Paleofavosites	D	1	T
787	B	Ch	A96		S	St	—	Ecclimadictyon	D	0	
788	B	Ch	A96		S	St	—	Ecclimadictyon	L	0	
789	B	Ch	A96		S	St	—	Ecclimadictyon	L	0	

790	B	Ch	A96		S	St	—	<i>Ecclimadictyon</i>	L	0	
1336	B	Ch	A96		S	St	—	<i>Ecclimadictyon</i>	L	1	T
781	B	Ch	A96		S	Tb	fav	<i>Paleofavosites</i>	L	0	
782	B	Ch	A96		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
783	B	Ch	A96		S	Tb	fav	<i>Paleofavosites</i>	L	0	
784	B	Ch	A96		S	Tb	fav	<i>Paleofavosites</i>	D	0	
785	B	Ch	A96		S	Tb	fav	<i>Paleofavosites</i>	L	0	
786	B	Ch	A96		S	Tb	fav	<i>Paleofavosites</i>	D	0	
1335	B	Ch	A96a		S	St	—	<i>Ecclimadictyon</i>	L	1	T
773	B	Ch	A97-2		S	St	—	<i>Ecclimadictyon</i>	D	0	
1327	B	Ch	A97-2	a	S	St	—	<i>Ecclimadictyon</i>	D	1	T
1328	B	Ch	A97-2	b	S	St	—	<i>Ecclimadictyon</i>	D	0	
1329	B	Ch	A97-2	c	S	St	—	<i>Ecclimadictyon</i>	L	1	T
774	B	Ch	A97-2		S	Tb	fav	? <i>Favosites</i>	D	0	
775	B	Ch	A97-2		S	Tb	fav	<i>Favosites</i>	D	0	
794	B	Ch/FP	A142		S	Tb	hel	<i>Propora conferta</i>	H	0	
810	B	FP	A1070		S	Tb	hel	<i>Propora conferta</i>	D	0	
978	B	FP	A1294		S	St	—	<i>Ecclimadictyon</i>	D	0	
979	B	FP	A1294		S	St	—	<i>Ecclimadictyon</i>	D	0	
980	B	FP	A1294		S	St	—	<i>Ecclimadictyon</i>	D	0	
981	B	FP	A1294		S	St	—	<i>Ecclimadictyon</i>	D	0	
982	B	FP	A1294		S	St	—	<i>Ecclimadictyon</i>	D	0	
983	B	FP	A1294		S	Tb	hel	<i>Propora conferta</i>	L	0	
984	B	FP	A1294		S	Tb	hel	<i>Propora conferta</i>	D	0	
985	B	FP	A1294	11	S	Tb	hel	<i>Propora conferta</i>	L	0	
809	B	FP	A314a		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
808	B	FP	A590		S	Tb	fav	<i>Paleofavosites</i>	L	1	T
558	B	FP	A590c		S	St	—	<i>Ecclimadictyon</i>	L	0	
555	B	FP	A590c		S	Tb	fav	<i>Paleofavosites</i>	D	0	
556	B	FP	A590c		S	Tb	fav	<i>Paleofavosites</i>	D	0	
552	B	FP	A590c		S	Tb	hel	<i>Propora speciosa</i>	H	0	
553	B	FP	A590c		S	Tb	hel	<i>Propora speciosa</i>	L	0	
554	B	FP	A590c		S	Tb	hel	<i>Propora speciosa</i>	S	1	T
557	B	FP	A590c		S	Tb	hel	<i>Propora conferta</i>	D	1	T
814	B	FP	A67		S	Tb	hel	<i>Propora conferta</i>	D	1	T
1003	B	FP	A815		M	Tb	fav	<i>Paleofavosites</i>	C	1	T
812	B	FP	A901		S	Tb	fav	<i>Paleofavosites</i>	D	0	
813	B	FP	A901		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
1013	EB	?	A496		S	Tb	fav	<i>Paleofavosites</i>	D	4	T
2358	EB/V	?	?		M	Tb	hel	<i>Protrochiscolithus</i>	L	2	T
560	EB	L	A1072		S	St	—	<i>Ecclimadictyon</i>	H	0	
561	EB	L	A1072		S	St	—	<i>Ecclimadictyon</i>	H	1	T
550	EB	L	A1072		S	Tb	hel	<i>Propora conferta</i>	S	0	
551	EB	L	A1072		S	Tb	hel	<i>Propora conferta</i>	D	0	
639	EB	L	A1075	2	R	St	—	<i>Ecclimadictyon</i>	H	0	
640	EB	L	A1075	1	R	St	—	<i>Ecclimadictyon</i>	L	0	
648	EB	L	A1075	7	R	St	—	<i>Ecclimadictyon</i>	L	0	
546	EB	L	A1075		R	Tb	hel	<i>Propora conferta</i>	S	0	
811	EB	L	A1075		R	Tb	hel	<i>Propora conferta</i>	D	0	
589	EB	L	A1076		R	St	—	? <i>Pachystylostroma</i>	D	0	
573	EB	L	A1161		R	Tb	hel	<i>Propora conferta</i>	H	0	
627	EB	L	A1176		R	St	—	? <i>Pachystylostroma</i>	L	0	
628	EB	L	A1176		R	St	—	? <i>Pachystylostroma</i>	D	0	
577	EB	L	A1191		S	St	—	? <i>Pachystylostroma</i>	D	0	
580	EB	L	A1191		S	St	—	<i>Ecclimadictyon</i>	D	0	

581	EB	L	A1191	4	S	St	—	<i>Ecclimadictyon</i>	D	0	
582	EB	L	A1191	3	S	St	—	<i>Ecclimadictyon</i>	D	1	T
583	EB	L	A1191		S	St	—	? <i>Pachystylostroma</i>	L	0	
584	EB	L	A1191	6	S	St	—	? <i>Pachystylostroma</i>	L	0	
585	EB	L	A1191		S	Tb	fav	<i>Paleofavosites</i>	S	1	T
1039	EB	L	A1191		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
574	EB	L	A1191		S	Tb	hel	<i>Propora speciosa</i>	D	1	T
575	EB	L	A1191		S	Tb	hel	<i>Propora conferta</i>	D	1	T
576	EB	L	A1191		S	Tb	hel	<i>Propora conferta</i>	D	0	
578	EB	L	A1191		S	Tb	hel	? <i>Coccoseris</i>	D	1	T
579	EB	L	A1191	1	S	Tb	hel	? <i>Coccoseris</i>	D	1	T
502	EB	L	A1194		R	St	—	?	D	1	T
501	EB	L	A1194		R	Tb	hel	?	D	2	T
507	EB	L	A1194		R	Tb	hel	<i>Propora conferta</i>	C	0	
539	EB	L	A1294		S	St	—	? <i>Clathrodictyon</i>	T	0	
633	EB	L	A136		R	St	—	<i>Ecclimadictyon</i>	L	0	
642	EB	L	A136	4	R	St	—	<i>Ecclimadictyon</i>	D	0	
540	EB	L	A136		R	Tb	hel	<i>Propora conferta</i>	H	1	T
622	EB	L	A363-4	2	R	St	—	<i>Ecclimadictyon</i>	D	1	T
623	EB	L	A363-4	1	R	St	—	<i>Ecclimadictyon</i>	D	0	
624	EB	L	A363-4		R	St	—	<i>Ecclimadictyon</i>	D	1	T
625	EB	L	A363-4		R	St	—	<i>Ecclimadictyon</i>	L	1	T
646	EB	L	A41		R	St	—	<i>Ecclimadictyon</i>	H	0	
647	EB	L	A41	e	R	St	—	<i>Ecclimadictyon</i>	D	0	
541	EB	L	A41		R	Tb	hel	<i>Propora conferta</i>	H	1	T
542	EB	L	A41	a	R	Tb	hel	<i>Propora speciosa</i>	H	0	
543	EB	L	A41		R	Tb	hel	<i>Propora conferta</i>	L	2	T
544	EB	L	A41	d	R	Tb	hel	<i>Propora conferta</i>	H	0	
545	EB	L	A41	f	R	Tb	hel	<i>Propora speciosa</i>	S	0	
80	EB	L	A41e		R	Tb	hel	<i>Propora conferta</i>	H	0	
538	EB	L	A429		R	Tb	hel	<i>Propora speciosa</i>	H	0	
562	EB	L	A436	5	R	St	—	<i>Ecclimadictyon</i>	D	1	T
564	EB	L	A436		R	St	—	<i>Ecclimadictyon</i>	H	0	
568	EB	L	A436		R	St	—	<i>Ecclimadictyon</i>	D	1	T
569	EB	L	A436		R	St	—	<i>Ecclimadictyon</i>	D	0	
570	EB	L	A436		R	St	—	<i>Ecclimadictyon</i>	D	1	T
571	EB	L	A436		R	St	—	<i>Ecclimadictyon</i>	D	0	
617	EB	L	A436		R	St	—	<i>Ecclimadictyon</i>	H	1	T
618	EB	L	A436	7	R	St	—	<i>Ecclimadictyon</i>	D	0	
619	EB	L	A436	4	R	St	—	? <i>Ecclimadictyon</i>	H	0	
620	EB	L	A436		R	St	—	?	D	1	T
621	EB	L	A436		R	St	—	? <i>Pachystylostroma</i>	D	0	
635	EB	L	A436	1	R	St	—	<i>Ecclimadictyon</i>	D	1	T
563	EB	L	A436		R	Tb	hel	<i>Propora speciosa</i>	H	0	
565	EB	L	A436	4	R	Tb	hel	<i>Propora speciosa</i>	C	0	
566	EB	L	A436		R	Tb	hel	<i>Propora conferta</i>	C	0	
567	EB	L	A436		R	Tb	hel	<i>Propora conferta</i>	H	1	T
572	EB	L	A436	10	R	Tb	hel	<i>Propora speciosa</i>	H	0	
634	EB	L	A436	1	R	Tb	hel	? <i>Acidolites</i>	L	1	T
636	EB	L	A436	1	R	Tb	hel	<i>Propora conferta</i>	H	1	T
637	EB	L	A436	3	R	Tb	hel	<i>Propora conferta</i>	D	1	T
638	EB	L	A436	3	R	Tb	hel	? <i>Acidolites</i>	L	2	T
643	EB	L	A442	2	R	St	—	<i>Clathrodictyon</i>	D	2	T
644	EB	L	A442	11	R	St	—	<i>Clathrodictyon</i>	D	0	
453	EB	L	A442	13	R	Tb	sar	? <i>Calapoecia</i>	H	0	

616	EB	L	A590		S	St	—	<i>Ecclimadictyon</i>	L	1	T
630	EB	L	A590b		S	St	—	<i>Ecclimadictyon</i>	D	0	
631	EB	L	A590b		S	St	—	<i>Ecclimadictyon</i>	D	0	
632	EB	L	A590b		S	St	—	<i>Ecclimadictyon</i>	D	0	
682	EB	L	A593	7	R	Tb	fav	<i>Paleofavosites</i>	H	1	T
1588	EB	L	A593a	7	R	St	aul		C	0	
1589	EB	L	A593a	10	R	St	aul		C	0	
1590	EB	L	A593a	11	R	St	aul		C	0	
1632	EB	L	A593a	5	R	St	aul		C	0	
473	EB	L	A593a		R	St	—	? <i>Clathrodiction</i>	L	0	
477	EB	L	A593a	8	R	St	—	? <i>Clathrodiction</i>	T	0	
478	EB	L	A593a		R	St	—	<i>Ecclimadictyon</i>	D	0	
483	EB	L	A593a	14	R	St	—	<i>Ecclimadictyon</i>	D	0	
490	EB	L	A593a		R	St	—	<i>Ecclimadictyon</i>	D	0	
626	EB	L	A593a	13	R	St	—	? <i>Pachystylostroma</i>	H	1	T
181	EB	L	A593a		R	Tb	hel	<i>Propora speciosa</i>	H	1	T
182	EB	L	A593a		R	Tb	hel	<i>Propora speciosa</i>	H	0	
474	EB	L	A593a	2	R	Tb	hel	<i>Propora conferta</i>	H	0	
475	EB	L	A593a	3	R	Tb	hel	<i>Propora conferta</i>	H	0	
476	EB	L	A593a	3	R	Tb	hel	<i>Propora conferta</i>	H	0	
479	EB	L	A593a		R	Tb	hel	<i>Propora conferta</i>	D	0	
480	EB	L	A593a	12	R	Tb	hel	<i>Propora conferta</i>	H	1	T
481	EB	L	A593a	10	R	Tb	hel	<i>Propora conferta</i>	H	1	T
482	EB	L	A593a	4	R	Tb	hel	<i>Propora conferta</i>	H	0	
484	EB	L	A593a		R	Tb	hel	<i>Propora conferta</i>	D	0	
485	EB	L	A593a		R	Tb	hel	<i>Propora conferta</i>	D	0	
486	EB	L	A593a		R	Tb	hel	<i>Propora conferta</i>	D	0	
487	EB	L	A593a		R	Tb	hel	<i>Propora conferta</i>	H	0	
488	EB	L	A593a		R	Tb	hel	<i>Propora conferta</i>	H	0	
489	EB	L	A593a		R	Tb	hel	<i>Propora conferta</i>	D	0	
645	EB	L	A737	4	R	St	—	<i>Ecclimadictyon</i>	D	2	T
496	EB	L	A737		R	Tb	fav	<i>Paleofavosites</i>	T	0	
497	EB	L	A737		R	Tb	fav	<i>Paleofavosites</i>	L	0	
498	EB	L	A737		R	Tb	fav	<i>Paleofavosites</i>	T	0	
491	EB	L	A737		R	Tb	hel	<i>Propora conferta</i>	D	0	
492	EB	L	A737		R	Tb	hel	<i>Propora conferta</i>	D	0	
493	EB	L	A737		R	Tb	hel	<i>Propora conferta</i>	D	0	
494	EB	L	A737		R	Tb	hel	<i>Propora conferta</i>	H	0	
495	EB	L	A737		R	Tb	hel	<i>Propora conferta</i>	D	0	
500	EB	L	A737	2	R	Tb	hel	<i>Propora conferta</i>	H	0	
526	EB	L	A738	9	R	Tb	fav	<i>Paleofavosites</i>	D	0	
528	EB	L	A738	16	R	Tb	fav	<i>Paleofavosites</i>	D	0	
529	EB	L	A738	68	R	Tb	fav	<i>Paleofavosites</i>	D	0	
530	EB	L	A738	8	R	Tb	fav	<i>Paleofavosites</i>	D	0	
533	EB	L	A738	4	R	Tb	fav	<i>Paleofavosites</i>	D	1	T
534	EB	L	A738	62	R	Tb	fav	<i>Paleofavosites</i>	D	1	T
535	EB	L	A738	5	R	Tb	fav	<i>Paleofavosites</i>	D	1	T
536	EB	L	A738	27	R	Tb	fav	<i>Paleofavosites</i>	D	0	
516	EB	L	A738	10	R	Tb	hel	<i>Propora conferta</i>	D	1	T
517	EB	L	A738	22	R	Tb	hel	<i>Propora conferta</i>	D	0	
518	EB	L	A738	11	R	Tb	hel	<i>Propora conferta</i>	D	0	
519	EB	L	A738	35	R	Tb	hel	<i>Propora conferta</i>	D	1	T
520	EB	L	A738	44	R	Tb	hel	<i>Propora conferta</i>	H	1	T
521	EB	L	A738	48	R	Tb	hel	<i>Propora conferta</i>	D	0	
522	EB	L	A738	33	R	Tb	hel	<i>Propora speciosa</i>	S	1	T

523	EB	L	A738	25	R	Tb	hel	<i>Propora speciosa</i>	M	1	T
524	EB	L	A738	38	R	Tb	hel	<i>Propora speciosa</i>	D	1	T
525	EB	L	A738		R	Tb	hel	<i>Propora conferta</i>	D	0	
527	EB	L	A738	17	R	Tb	hel	<i>Propora conferta</i>	D	1	T
531	EB	L	A738	19	R	Tb	hel	<i>Propora conferta</i>	H	0	
532	EB	L	A738	7	R	Tb	hel	<i>Propora conferta</i>	S	0	
537	EB	L	A738	1	R	Tb	hel	<i>Propora conferta</i>	S	0	
586	EB	L	A892	21	R	St	—	<i>Ecclimadictyon</i>	H	0	
587	EB	L	A892	9	R	St	—	<i>Ecclimadictyon</i>	D	1	T
629	EB	L	A892	58	R	St	—	? <i>Pachystylostroma</i>	D	0	
549	EB	L	A892		R	Tb	fav	<i>Paleofavosites</i>	D	0	
547	EB	L	A892		R	Tb	hel	<i>Propora conferta</i>	H	0	
548	EB	L	A892		R	Tb	hel	<i>Propora conferta</i>	S	1	T
505	EB	L	A894		R	St	—	<i>Ecclimadictyon</i>	D	0	
506	EB	L	A894		R	St	—	<i>Ecclimadictyon</i>	L	0	
508	EB	L	A894		R	St	—	<i>Ecclimadictyon</i>	D	0	
509	EB	L	A894		R	St	—	<i>Ecclimadictyon</i>	D	0	
510	EB	L	A894		R	St	—	<i>Ecclimadictyon</i>	L	0	
511	EB	L	A894		R	St	—	<i>Ecclimadictyon</i>	D	0	
512	EB	L	A894		R	St	—	<i>Ecclimadictyon</i>	D	0	
513	EB	L	A894		R	St	—	<i>Ecclimadictyon</i>	T	0	
515	EB	L	A894		R	St	—	<i>Ecclimadictyon</i>	S	0	
514	EB	L	A894		R	Tb	hel	<i>Propora speciosa</i>	S	0	
1029	EB	L/LC	?		S	St	—	<i>Pachystylostroma</i>	D	0	
559	EB	L/LC	A590	7	S	Tb	fav	<i>Paleofavosites</i>	S	1	T
1610	EB	LC	A1175		M	St	aul		C	2	T
455	EB	LC	A1175		M	Tb	hel	<i>Propora conferta</i>	D	3	T, L
1576	EB	LC	A146	6	S	St	aul		C	0	
1577	EB	LC	A146	3	S	St	aul		C	0	
1578	EB	LC	A146	4	S	St	aul		C	0	
1600	EB	LC	A146	9	S	St	aul		C	0	
614	EB	LC	A146		S	St	—	? <i>Pachystylostroma</i>	L	1	T
463	EB	LC	A146		S	Tb	fav	<i>Paleofavosites</i>	D	0	
459	EB	LC	A146		S	Tb	hel	<i>Propora speciosa</i>	D	0	
460	EB	LC	A146		S	Tb	hel	<i>Propora conferta</i>	D	1	T
461	EB	LC	A146		S	Tb	hel	<i>Propora conferta</i>	D	0	
462	EB	LC	A146		S	Tb	hel	<i>Propora speciosa</i>	S	0	
464	EB	LC	A146		S	Tb	hel	<i>Propora conferta</i>	D	0	
456	EB	LC	A313-6		S	Tb	fav	<i>Paleofavosites</i>	D	0	
1627	EB	LC	A313c		S	St	aul		C	0	
613	EB	LC	A313c		S	St	—	<i>Ecclimadictyon</i>	D	1	T
466	EB	LC	A428a		M	Tb	hel	<i>Propora conferta</i>	H	1	T
468	EB	LC	A428a		M	Tb	hel	<i>Propora conferta</i>	D	2	T
467	EB	LC	A428c	1	S	Tb	hel	<i>Propora conferta</i>	H	1	T
1602	EB	LC	A436b		S	St	aul		C	5	T
588	EB	LC	A538	6	M	St	—	? <i>Pachystylostroma</i>	L	0	
1524	EB	LC	A895	62	M	St	aul		C	1	T
1629	EB	LC	A895	1	M	St	aul		C	0	
1622	EB	LC	A972		M	St	aul		C	1	T
1623	EB	LC	A972		M	St	aul		C	0	
1624	EB	LC	A972		M	St	aul		C	0	
1625	EB	LC	A972		M	St	aul		C	0	
1626	EB	LC	A972		M	St	aul		C	0	
1628	EB	LC	A972		M	St	aul		C	0	
400	EB	LC/P	A427		M	Tb	fav	<i>Paleofavosites</i>	D	1	T

371	EB	P	?		M	Tb	hel	<i>Propora conferta</i>	D	1	T
1583	EB	P	A1163	4	S	St	aul		C	0	
1892	EB	P	A1163	3	S	St	aul		C	1	T
1893	EB	P	A1163	6	S	St	aul		C	0	
1894	EB	P	A1163	1	S	St	aul		C	0	
1895	EB	P	A1163	5	S	St	aul		C	2	T
1896	EB	P	A1163	7	S	St	aul		C	1	T
1897	EB	P	A1163	2	S	St	aul		C	1	T
1898	EB	P	A1163		S	St	aul		C	0	
1046	EB	P	A1173		M	Tb	sar	<i>Calapoecia</i>	D	2	T
610	EB	P	A1195		S	Tb	hel	<i>Propora speciosa</i>	D	2	T, L
1691	EB	P	A122	5	R	St	aul		C	0	
1692	EB	P	A122	6	R	St	aul		C	0	
1693	EB	P	A122	3	R	St	aul		C	0	
1694	EB	P	A122	2	R	St	aul		C	0	
1695	EB	P	A122	1	R	St	aul		C	0	
1696	EB	P	A122	4	R	St	aul		C	1	T
388	EB	P	A122		R	Tb	fav	<i>Paleofavosites</i>	D	2	T
389	EB	P	A122		R	Tb	fav	<i>Paleofavosites</i>	L	1	T
1712	EB	P	A1269		S	St	aul		C	0	
1713	EB	P	A1269		S	St	aul		C	0	
1714	EB	P	A1269		S	St	aul		C	0	
295	EB	P	A1270		S	Tb	sar	<i>Columnopora</i>	H	1	T
1550	EB	P	A1271	15	R	St	aul		C	0	
1900	EB	P	A1271		R	St	aul		C	0	
377	EB	P	A1271		R	St	—	?	T	0	
380	EB	P	A1271	61	R	St	—	<i>Clathrodictyon</i>	M	0	
375	EB	P	A1271		R	Tb	fav	<i>Paleofavosites</i>	H	0	
381	EB	P	A1271		R	Tb	fav	<i>Paleofavosites</i>	S	1	T
382	EB	P	A1271		R	Tb	fav	<i>Paleofavosites</i>	S	0	
383	EB	P	A1271		R	Tb	fav	<i>Paleofavosites</i>	M	0	
396	EB	P	A1271		R	Tb	fav	<i>Paleofavosites</i>	T	0	
397	EB	P	A1271		R	Tb	fav	<i>Paleofavosites</i>	L	0	
398	EB	P	A1271		R	Tb	fav	<i>Paleofavosites</i>	L	0	
1012	EB	P	A1271		R	Tb	fav	<i>Paleofavosites</i>	D	0	
1040	EB	P	A1271		R	Tb	fav	<i>Paleofavosites</i>	M	2	T
296	EB	P	A1271		R	Tb	hel	? <i>Pycnolithus</i>	T	1	T
376	EB	P	A1271		R	Tb	hel	<i>Ellisites labechioides</i>	M	1	T
378	EB	P	A1271		R	Tb	hel	? <i>Ellisites astomata</i>	H	2	T
379	EB	P	A1271		R	Tb	hel	<i>Ellisites labechioides</i>	D	0	
391	EB	P	A1271		R	Tb	hel	<i>Ellisites labechioides</i>	D	1	T
392	EB	P	A1271		R	Tb	hel	<i>Ellisites labechioides</i>	M	1	T
393	EB	P	A1271	3	R	Tb	hel	<i>Ellisites labechioides</i>	L	1	T
394	EB	P	A1271	1	R	Tb	hel	<i>Ellisites labechioides</i>	L	1	T
395	EB	P	A1271		R	Tb	hel	<i>Ellisites labechioides</i>	L	0	
1011	EB	P	A1271		R	Tb	hel	<i>Ellisites labechioides</i>	D	0	
1899	EB	P	A1271		R	Tb	hel	<i>Ellisites labechioides</i>	H	3	T
1644	EB	P	A1285		S	St	aul		C	0	
355	EB	P	A1285		S	Tb	fav	<i>Paleofavosites</i>	H	0	
641	EB	P	A1285		S	Tb	fav	<i>Paleofavosites</i>	H	1	T
1519	EB	P	A1286		M	St	aul		C	1	T
1542	EB	P	A1286	1	M	St	aul		C	4	T
1715	EB	P	A1286		M	St	aul		C	0	
1716	EB	P	A1286		M	St	aul		C	0	
1717	EB	P	A1286		M	St	aul		C	2	T

1718	EB	P	A1286		M	St	aul		C	3	T
1719	EB	P	A1286		M	St	aul		C	1	T
1019	EB	P	A1286		M	Tb	sar	<i>Columnopora</i>	D	1	T
285	EB	P	A1332		S	Tb	hel	<i>Propora conferta</i>	D	2	T
1591	EB	P	A134a	7	M	St	aul		C	0	
1592	EB	P	A134a	3	M	St	aul		C	0	
1593	EB	P	A134a	2	M	St	aul		C	0	
1594	EB	P	A134a	1	M	St	aul		C	0	
1595	EB	P	A134a	8	M	St	aul		C	0	
384	EB	P	A134a		M	Tb	fav	<i>Paleofavosites</i>	M	0	
385	EB	P	A134a		M	Tb	fav	<i>Paleofavosites</i>	D	0	
1596	EB	P	A135	9	M	St	aul		C	0	
1650	EB	P	A135	17	S	St	aul		C	0	
1651	EB	P	A135	19	S	St	aul		C	0	
1652	EB	P	A135	20	S	St	aul		C	0	
1653	EB	P	A135	16	S	St	aul		C	0	
1654	EB	P	A135	9	S	St	aul		C	0	
1655	EB	P	A135	8	S	St	aul		C	0	
1656	EB	P	A135	7	S	St	aul		C	0	
1657	EB	P	A135	6	S	St	aul		C	1	T
1658	EB	P	A135	5	S	St	aul		C	0	
1659	EB	P	A135	1	S	St	aul		C	0	
1660	EB	P	A135	4	S	St	aul		C	0	
1661	EB	P	A135	3	S	St	aul		C	0	
1662	EB	P	A135	2	S	St	aul		C	0	
255	EB	P	A135	4	M	Tb	fav	<i>Paleofavosites</i>	D	1	T
256	EB	P	A135		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
426	EB	P	A135		S	Tb	fav	<i>Paleofavosites</i>	H	0	
428	EB	P	A135		S	Tb	fav	<i>Paleofavosites</i>	L	0	
431	EB	P	A135	2	S	Tb	fav	<i>Paleofavosites</i>	H	1	T
432	EB	P	A135		S	Tb	fav	<i>Paleofavosites</i>	D	2	T
254	EB	P	A135	3	M	Tb	hel	<i>Propora conferta</i>	D	1	T
257	EB	P	A135		M	Tb	hel	<i>Ellisites labechioides</i>	M	1	T
429	EB	P	A135		S	Tb	hel	<i>Propora conferta</i>	D	1	T
430	EB	P	A135		S	Tb	hel	<i>Propora conferta</i>	D	0	
427	EB	P	A135		S	Tb	sar	<i>Columnopora</i>	D	0	
1549	EB	P	A138	1	S	St	aul		C	1	T
1705	EB	P	A138	3	S	St	aul		C	0	
1706	EB	P	A138		S	St	aul		C	0	
1707	EB	P	A138	1	S	St	aul		C	1	T
259	EB	P	A138		S	Tb	fav	<i>Paleofavosites</i>	H	0	
386	EB	P	A138		S	Tb	sar	<i>Columnopora</i>	D	0	
245	EB	P	A20		M	Tb	hel	<i>Propora conferta</i>	L	2	T
247	EB	P	A20		M	Tb	hel	<i>Propora conferta</i>	L	2	T
251	EB	P	A20		M	Tb	hel	<i>Propora conferta</i>	D	1	T
246	EB	P	A20		M	Tb	sar	<i>Calapoecia</i>	D	0	
248	EB	P	A20	1	M	Tb	sar	<i>Calapoecia</i>	D	3	T
249	EB	P	A20		M	Tb	sar	<i>Calapoecia</i>	D	1	T
250	EB	P	A20	6	M	Tb	sar	<i>Calapoecia</i>	D	2	T
252	EB	P	A20		M	Tb	sar	<i>Columnopora</i>	D	1	T
1024	EB	P	A20		M	Tb	sar	<i>Calapoecia</i>	D	2	T
1025	EB	P	A20	3	M	Tb	sar	<i>Calapoecia</i>	D	1	T, L
1499	EB	P	A213	1	M	St	aul		C	0	
1599	EB	P	A213	6	M	St	aul		C	0	
1708	EB	P	A213	3	M	St	aul		C	0	

1709	EB	P	A213	2	M	St	aul		C	0	
1710	EB	P	A213	4	M	St	aul		C	0	
1711	EB	P	A213	5	M	St	aul		C	1	T
293	EB	P	A213		M	Tb	hel	<i>Ellisites astomata</i>	L	4	T
471	EB	P	A213		M	Tb	hel	<i>Ellisites labechioides</i>	M	1	T
290	EB	P	A213	1	M	Tb	sar	<i>Calapoecia</i>	D	1	T
291	EB	P	A213		M	Tb	sar	<i>Calapoecia</i>	H	0	
292	EB	P	A213		M	Tb	sar	<i>Calapoecia</i>	D	0	
1630	EB	P	A218	2	M	St	aul		C	0	
1631	EB	P	A218	1	M	St	aul		C	0	
470	EB	P	A218E		S	Tb	fav	<i>Paleofavosites</i>	H	2	T
469	EB	P	A218E		S	Tb	hel	<i>Ellisites labechioides</i>	M	1	T
1489	EB	P	A219	9	S	St	aul		C	0	
1490	EB	P	A219	11	S	St	aul		C	1	T
1491	EB	P	A219	6	S	St	aul		C	0	
1492	EB	P	A219	14	S	St	aul		C	0	
1525	EB	P	A219	19	S	St	aul		C	1	T
1587	EB	P	A219	5	S	St	aul		C	0	
1688	EB	P	A219	7	M	St	aul		C	4	T
1689	EB	P	A219	18	M	St	aul		C	0	
1690	EB	P	A219	6	M	St	aul		C	0	
1697	EB	P	A219	17	M	St	aul		C	0	
1698	EB	P	A219	8	M	St	aul		C	1	T
1699	EB	P	A219	2	M	St	aul		C	0	
1700	EB	P	A219	4	M	St	aul		C	2	T
359	EB	P	A219		M	Tb	fav	<i>Paleofavosites</i>	H	1	T
360	EB	P	A219		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
437	EB	P	A219		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
438	EB	P	A219		M	Tb	fav	<i>Paleofavosites</i>	D	0	
441	EB	P	A219		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
1586	EB	P	A219	5	S	Tb	fav	<i>Paleofavosites</i>	D	0	
433	EB	P	A219		M	Tb	hel	<i>Ellisites labechioides</i>	D	1	T
434	EB	P	A219		M	Tb	hel	<i>Ellisites labechioides</i>	M	0	
436	EB	P	A219		M	Tb	hel	<i>Propora conferta</i>	L	2	T
439	EB	P	A219		M	Tb	hel	<i>Propora conferta</i>	D	3	T
358	EB	P	A219		M	Tb	sar	<i>Calapoecia</i>	D	2	T
435	EB	P	A219		M	Tb	sar	<i>Calapoecia</i>	D	0	
440	EB	P	A219		M	Tb	sar	<i>Calapoecia</i>	H	1	T
1571	EB	P	A220	3	S	St	aul		C	1	T
1572	EB	P	A220	1	S	St	aul		C	0	
363	EB	P	A220		S	Tb	fav	<i>Paleofavosites</i>	D	0	
304	EB	P	A220	11	S	Tb	hel	<i>Ellisites labechioides</i>	D	0	
472	EB	P	A220	11	S	Tb	hel	<i>Ellisites labechioides</i>	M	0	
1026	EB	P	A220		M	Tb	hel	<i>Ellisites labechioides</i>	H	1	T
356	EB	P	A220	1	S	Tb	sar	<i>?Calapoecia</i>	H	1	T
357	EB	P	A220		S	Tb	sar	<i>Calapoecia</i>	D	1	T
1506	EB	P	A315	15	M	St	aul		C	1	T
1507	EB	P	A315	44	M	St	aul		C	1	T
1508	EB	P	A315	43	M	St	aul		C	1	T
1509	EB	P	A315	42	M	St	aul		C	1	T
1518	EB	P	A315	26	M	St	aul		C	1	T
1521	EB	P	A315		M	St	aul		C	1	T
1541	EB	P	A315	14	M	St	aul		C	1	T
1573	EB	P	A315	8	M	St	aul		C	1	T
1585	EB	P	A315	6	M	St	aul		C	1	T

1597	EB	P	A315	4	M	St	aul		C	0	
1598	EB	P	A315	19	M	St	aul		C	0	
1827	EB	P	A315	31	S	St	aul		C	1	T
1828	EB	P	A315	39	S	St	aul		C	0	
1829	EB	P	A315	38	S	St	aul		C	1	T
1830	EB	P	A315	32	S	St	aul		C	0	
1831	EB	P	A315	62	S	St	aul		C	1	T
1832	EB	P	A315	30	S	St	aul		C	0	
1833	EB	P	A315		S	St	aul		C	0	
1834	EB	P	A315	23	S	St	aul		C	0	
1835	EB	P	A315	X	S	St	aul		C	0	
1836	EB	P	A315	54	S	St	aul		C	0	
1837	EB	P	A315	21	S	St	aul		C	0	
1838	EB	P	A315	35	S	St	aul		C	2	T
1839	EB	P	A315	60	S	St	aul		C	1	T
1840	EB	P	A315	60	S	St	aul		C	0	
1841	EB	P	A315	66	S	St	aul		C	0	
1842	EB	P	A315	45	S	St	aul		C	1	T
1843	EB	P	A315	39	S	St	aul		C	0	
1844	EB	P	A315	38	S	St	aul		C	1	T
1845	EB	P	A315	17	S	St	aul		C	1	T
1846	EB	P	A315	51	S	St	aul		C	1	T
1847	EB	P	A315		S	St	aul		C	1	T
1848	EB	P	A315	46	S	St	aul		C	0	
1849	EB	P	A315	58	S	St	aul		C	1	T
1850	EB	P	A315		S	St	aul		C	0	
1852	EB	P	A315	27	S	St	aul		C	0	
1853	EB	P	A315	40	S	St	aul		C	1	T
1854	EB	P	A315	44	S	St	aul		C	1	T
1855	EB	P	A315	49	S	St	aul		C	0	
1856	EB	P	A315	50	S	St	aul		C	0	
1858	EB	P	A315		S	St	aul		C	1	T
1861	EB	P	A315		S	St	aul		C	1	T
1862	EB	P	A315	41	S	St	aul		C	1	T
1863	EB	P	A315	47	S	St	aul		C	0	
1864	EB	P	A315	48	S	St	aul		C	3	T
1865	EB	P	A315	26	S	St	aul		C	0	
1866	EB	P	A315		S	St	aul		C	2	T
1867	EB	P	A315	53	S	St	aul		C	0	
1868	EB	P	A315	51	S	St	aul		C	1	T
1869	EB	P	A315	20	S	St	aul		C	0	
1870	EB	P	A315	20	S	St	aul		C	0	
1871	EB	P	A315	11	S	St	aul		C	4	T
1874	EB	P	A315	5	S	St	aul		C	0	
1875	EB	P	A315	19	S	St	aul		C	0	
1877	EB	P	A315	9L	S	St	aul		C	0	
1878	EB	P	A315	10	S	St	aul		C	0	
1879	EB	P	A315	10	S	St	aul		C	1	T
1880	EB	P	A315	17	S	St	aul		C	0	
1881	EB	P	A315	18	S	St	aul		C	0	
1882	EB	P	A315	12	S	St	aul		C	0	
1883	EB	P	A315	13	S	St	aul		C	0	
1885	EB	P	A315	1	S	St	aul		C	0	
1886	EB	P	A315	1.1	S	St	aul		C	0	
1888	EB	P	A315	3	S	St	aul		C	2	T

1889	EB	P	A315	16	S	St	aul		C	0	
1890	EB	P	A315	40	S	St	aul		C	2	T
1891	EB	P	A315	6	S	St	aul		C	2	T
1902	EB	P	A315	57	S	St	aul		C	1	T
1904	EB	P	A315	56	S	St	aul		C	1	T
1381	EB	P	A315		M	Tb	fav	<i>Paleofavosites</i>	H	0	
1385	EB	P	A315		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
1857	EB	P	A315		S	Tb	fav	<i>Paleofavosites</i>	D	0	
1007	EB	P	A315		M	Tb	hel	<i>Ellisites labechioides</i>	M	2	T
1384	EB	P	A315		M	Tb	hel	<i>Ellisites labechioides</i>	H	3	T
1520	EB	P	A315		M	Tb	hel	<i>Ellisites labechioides</i>	D	1	T
1851	EB	P	A315	27	S	Tb	hel	<i>Ellisites labechioides</i>	D	2	T
1859	EB	P	A315		S	Tb	hel	<i>Ellisites labechioides</i>	H	0	
1860	EB	P	A315		S	Tb	hel	<i>Ellisites labechioides</i>	M	1	T
1873	EB	P	A315	5	S	Tb	hel	<i>Ellisites labechioides</i>	H	2	T
1876	EB	P	A315	9L	S	Tb	hel	<i>Ellisites labechioides</i>	M	0	
1884	EB	P	A315	1	S	Tb	hel	<i>Ellisites labechioides</i>	D	2	T
1887	EB	P	A315	3	S	Tb	hel	<i>Ellisites labechioides</i>	H	1	T
1872	EB	P	A315	5	S	Tb	sar	<i>Columnopora</i>	D	1	T
407	EB	P	A359-1		S	Tb	fav	<i>Paleofavosites</i>	L	0	
408	EB	P	A359-1		S	Tb	sar	<i>Calapoecia</i>	L	1	T
401	EB	P	A359-1/3		M	Tb	hel	<i>Propora conferta</i>	L	0	
1701	EB	P	A362	2	S	St	aul		C	0	
1501	EB	P	A363e		S	St	aul		C	0	
458	EB	P	A363e		S	Tb	hel	<i>Propora conferta</i>	L	1	T
1903	EB	P	A407	12	S	St	aul		C	1	T
1905	EB	P	A407		S	St	aul		C	1	T
1906	EB	P	A407	15	S	St	aul		C	1	T
1907	EB	P	A407	22	S	St	aul		C	0	
1911	EB	P	A407	19	S	St	aul		C	0	
1913	EB	P	A407		S	St	aul		C	1	T
1914	EB	P	A407	11	S	St	aul		C	1	T
1916	EB	P	A407	21	S	St	aul		C	0	
1917	EB	P	A407		S	St	aul		C	0	
1918	EB	P	A407	2a	S	St	aul		C	0	
1919	EB	P	A407	2b	S	St	aul		C	0	
1920	EB	P	A407	8	S	St	aul		C	0	
1921	EB	P	A407	6	S	St	aul		C	0	
1922	EB	P	A407	10	S	St	aul		C	0	
1923	EB	P	A407	4	S	St	aul		C	0	
1924	EB	P	A407	12	S	St	aul		C	1	T
1925	EB	P	A407	7	S	St	aul		C	0	
1926	EB	P	A407	14	S	St	aul		C	0	
1927	EB	P	A407	9	S	St	aul		C	0	
1915	EB	P	A407	21	S	Tb	hel	<i>Ellisites labechioides</i>	D	2	T
288	EB	P	A42		M	Tb	sar	<i>Calapoecia</i>	L	1	T
465	EB	P	A437	1	M	Tb	hel	<i>Propora conferta</i>	D	3	T
1540	EB	P	A466		M	St	aul		C	0	
1539	EB	P	A466		M	Tb	hel	<i>Ellisites labechioides</i>	D	0	
1510	EB	P	A466a	12	M	St	aul		C	0	
1511	EB	P	A466a		M	St	aul		C	1	T
1512	EB	P	A466a		M	St	aul		C	0	
1513	EB	P	A466a		M	St	aul		C	0	
1514	EB	P	A466a		M	St	aul		C	0	
1515	EB	P	A466a		M	St	aul		C	0	

1523	EB	P	A466a		M	St	aul		C	0	
1639	EB	P	A466a	4	M	St	aul		C	0	
1640	EB	P	A466a	5	M	St	aul		C	0	
1641	EB	P	A466a	6	M	St	aul		C	0	
1643	EB	P	A466a	7	M	St	aul		C	0	
1522	EB	P	A466a		M	Tb	hel	<i>Ellisites labechioides</i>	D	1	T
1638	EB	P	A466a	4	M	Tb	hel	<i>Ellisites labechioides</i>	D	0	
1642	EB	P	A466a	7	M	Tb	hel	<i>Ellisites labechioides</i>	H	2	T
1646	EB	P	A466b	7	M	St	aul		C	1	T
1647	EB	P	A466b		M	St	aul		C	0	
1648	EB	P	A466b	6	M	St	aul		C	0	
1649	EB	P	A466b		M	St	aul		C	0	
373	EB	P	A466b		M	Tb	hel	<i>Ellisites labechioides</i>	M	1	T
1645	EB	P	A466c	1	M	St	aul		C	1	T
374	EB	P	A466c		M	Tb	fav	<i>Paleofavosites</i>	D	0	
1004	EB	P	A466c		M	Tb	fav	<i>Paleofavosites</i>	H	1	T
1517	EB	P	A468	5	S	St	aul		C	1	T
1516	EB	P	A468	5	S	Tb	hel	<i>Ellisites labechioides</i>	D	2	T
1824	EB	P	A468-1		M	St	aul		C	0	
1535	EB	P	A468b	11	S	St	aul		C	1	T
1536	EB	P	A468b	6	S	St	aul		C	0	
1537	EB	P	A468b	19	S	St	aul		C	0	
1544	EB	P	A468b	10	S	St	aul		C	1	T
1545	EB	P	A468b	17	S	St	aul		C	4	T
1546	EB	P	A468b	26	S	St	aul		C	0	
1548	EB	P	A468b	12	S	St	aul		C	1	T
1723	EB	P	A468b	14	M	St	aul		C	0	
1725	EB	P	A468b	11	M	St	aul		C	0	
1726	EB	P	A468b	15	M	St	aul		C	0	
1727	EB	P	A468b	8	M	St	aul		C	2	T
1728	EB	P	A468b	13	M	St	aul		C	0	
1729	EB	P	A468b	7	M	St	aul		C	0	
1730	EB	P	A468b		M	St	aul		C	0	
1731	EB	P	A468b	4	M	St	aul		C	0	
1732	EB	P	A468b	9	M	St	aul		C	0	
1908	EB	P	A468b	1	S	St	aul		C	0	
1910	EB	P	A468b		S	St	aul		C	0	
262	EB	P	A468b		S	Tb	fav	<i>Paleofavosites</i>	L	0	
263	EB	P	A468b		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
265	EB	P	A468b		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
266	EB	P	A468b		S	Tb	fav	<i>Paleofavosites</i>	H	2	T
270	EB	P	A468b		S	Tb	fav	<i>Paleofavosites</i>	H	0	
307	EB	P	A468b		S	Tb	fav	<i>Paleofavosites</i>	S	1	T
424	EB	P	A468b		S	Tb	fav	<i>Paleofavosites</i>	C	4	T
1722	EB	P	A468b	14	M	Tb	fav	<i>Paleofavosites</i>	D	0	
1909	EB	P	A468b		S	Tb	fav	<i>Paleofavosites</i>	D	4	T
267	EB	P	A468b		S	Tb	hel	<i>Ellisites labechioides</i>	M	1	T
268	EB	P	A468b		S	Tb	hel	<i>Ellisites labechioides</i>	M	0	
269	EB	P	A468b		S	Tb	hel	<i>Ellisites labechioides</i>	M	0	
1534	EB	P	A468b	11	S	Tb	hel	<i>Ellisites labechioides</i>	D	1	T
1547	EB	P	A468b	12	S	Tb	hel	<i>Ellisites labechioides</i>	D	3	T
1721	EB	P	A468b	14	M	Tb	hel	<i>Ellisites labechioides</i>	D	1	T
1724	EB	P	A468b	11	M	Tb	hel	<i>Ellisites labechioides</i>	D	1	T
264	EB	P	A468b		S	Tb	sar	<i>Calapoecia</i>	S	0	
1503	EB	P	A496		S	St	aul		C	0	

1504	EB	P	A496		S	St	aul		C	0	
1505	EB	P	A496		S	St	aul		C	0	
1560	EB	P	A496	7	S	St	aul		C	0	
1565	EB	P	A496	2	S	St	aul		C	0	
271	EB	P	A496		M	Tb	fav	<i>Paleofavosites</i>	S	0	
274	EB	P	A496		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
272	EB	P	A496		M	Tb	hel	<i>Ellisites astomata</i>	H	1	T
273	EB	P	A496		M	Tb	sar	<i>Columnopora</i>	D	1	T
294	EB	P	A516		M	Tb	sar	<i>Calapoecia</i>	D	2	T
615	EB	P	A542		M	St	—	<i>Labyrinthodictyon</i>	L	2	T
387	EB	P	A592		S	Tb	fav	<i>Paleofavosites</i>	D	0	
361	EB	P	A592b	15	S	Tb	fav	<i>Paleofavosites</i>	D	1	T
364	EB	P	A592b	5	S	Tb	fav	<i>Paleofavosites</i>	D	1	T
365	EB	P	A592b	8	S	Tb	fav	<i>Paleofavosites</i>	L	1	T
366	EB	P	A592b	7	S	Tb	fav	<i>Paleofavosites</i>	L	1	T
367	EB	P	A592b	21	S	Tb	fav	<i>Paleofavosites</i>	D	0	
368	EB	P	A592b		S	Tb	fav	<i>Paleofavosites</i>	H	1	T
369	EB	P	A592b	18	S	Tb	fav	<i>Paleofavosites</i>	D	1	T
370	EB	P	A592b	23	S	Tb	fav	<i>Paleofavosites</i>	H	2	T
362	EB	P	A592b	9	S	Tb	hel	<i>Propora conferta</i>	D	0	
1607	EB	P	A594a	28	S	St	aul		C	0	
411	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	H	1	T
412	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	D	0	
413	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	D	0	
414	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	D	0	
415	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	D	0	
417	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	D	0	
419	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
421	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	H	1	T
422	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
423	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	D	2	T
454	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	D	2	T
685	EB	P	A594a		M	Tb	fav	<i>Paleofavosites</i>	L	1	T
686	EB	P	A594a		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
688	EB	P	A594a		M	Tb	fav	<i>Paleofavosites</i>	H	3	T
986	EB	P	A594a		S	Tb	fav	<i>Paleofavosites</i>	H	2	T
410	EB	P	A594a		M	Tb	hel	<i>Propora conferta</i>	H	0	
420	EB	P	A594a		S	Tb	hel	<i>Ellisites labechioides</i>	M	1	T
687	EB	P	A594a		M	Tb	hel	<i>Ellisites labechioides</i>	M	1	T
416	EB	P	A594a		S	Tb	sar	<i>Columnopora</i>	D	0	
418	EB	P	A594a		S	Tb	sar	<i>Calapoecia</i>	L	1	T
684	EB	P	A594a		M	Tb	sar	<i>Calapoecia</i>	D	1	T
1686	EB	P	A595		M	St	aul		C	0	
1687	EB	P	A595		M	St	aul		C	0	
1495	EB	P	A810d	2	M	St	aul		C	0	
1496	EB	P	A810d	3	M	St	aul		C	0	
1497	EB	P	A810d	1	M	St	aul		C	0	
1498	EB	P	A810d		M	St	aul		C	0	
286	EB	P	A810d		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
287	EB	P	A810d		M	Tb	hel	<i>Propora conferta</i>	S	0	
305	EB	P	A810d		M	Tb	hel	<i>Ellisites labechioides</i>	L	0	
306	EB	P	A82		M	Tb	sar	<i>Calapoecia</i>	D	1	T
372	EB	P	C696		M	Tb	sar	<i>Calapoecia</i>	D	3	T
402	EB	V	A1170b		M	Tb	hel	<i>Propora conferta</i>	D	1	T
403	EB	V	A1170b		M	Tb	hel	<i>Propora conferta</i>	D	1	T

404	EB	V	A1170b		M	Tb	hel	<i>Propora conferta</i>	S	1	T
405	EB	V	A1170b		M	Tb	hel	<i>Propora conferta</i>	D	0	
406	EB	V	A1170b		M	Tb	hel	<i>Propora conferta</i>	S	0	
1636	EB	V	A133	1	M	St	aul		C	0	
206	EB	V	A133		M	Tb	fav	<i>Paleofavosites</i>	D	2	T
284	EB	V	A1334a		M	Tb	sar	<i>Calapoecia</i>	D	1	T
312	EB	V	A1372		S	Tb	sar	<i>Columnopora</i>	D	1	T
1620	EB	V	A201		S	St	aul		C	0	
1633	EB	V	A212	1	M	St	aul		C	1	T
1037	EB	V	A212		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
281	EB	V	A212	1	M	Tb	hel	<i>Ellisites labechioides</i>	H	1	T
282	EB	V	A212	2	M	Tb	hel	<i>Ellisites labechioides</i>	D	1	T
1702	EB	V	A357	1	M	St	aul		C	0	
1703	EB	V	A357	2	M	St	aul		C	0	
1704	EB	V	A357		M	St	aul		C	0	
309	EB	V	A366		S	Tb	fav	<i>Paleofavosites</i>	L	1	T
308	EB	V	A366		S	Tb	hel	<i>Ellisites labechioides</i>	H	1	T
310	EB	V	A366		S	Tb	sar	<i>Columnopora</i>	D	1	T
289	EB	V	A39		M	Tb	sar	<i>Calapoecia</i>	H	1	T
1050	EB	V	A39		M	Tb	sar	<i>Calapoecia</i>	D	1	T, L
1720	EB	V	A468a		M	St	aul		C	0	
354	EB	V	A594b		M	Tb	hel	<i>Ellisites labechioides</i>	T	3	T
683	EB	V	A594b		M	Tb	hel	<i>Protrochiscolithus</i>	D	5	T
457	EB	V	A74		M	Tb	hel	<i>Propora conferta</i>	D	1	T
1635	EB	V	A774		M	St	aul		C	0	
280	EB	V	A774		M	Tb	hel	? <i>Acidolites</i>	L	4	T
283	EB	V	A84		M	Tb	hel	<i>Propora conferta</i>	D	2	T
1637	EB	V	A905		M	St	aul		C	0	
279	EB	V	C720		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
277	EB	V	C720		M	Tb	hel	<i>Propora conferta</i>	D	2	T
278	EB	V	C720		M	Tb	sar	<i>Columnopora</i>	D	0	
1580	EB	V	C720a		M	St	aul		C	1	T
303	EB	V/Gr	A220		S	Tb	fav	<i>Paleofavosites</i>	H	1	T
1010	EB	V/Gr	A496		S	Tb	fav	<i>Paleofavosites</i>	H	1	T
1031	EB	V/Gr	A496		S	Tb	fav	<i>Paleofavosites</i>	D	3	T
1054	EB	V/Gr	A496		S	Tb	fav	<i>Paleofavosites</i>	H	2	T
1055	EB	V/Gr	A496		S	Tb	fav	<i>Paleofavosites</i>	H	2	T
1912	EB	V/Gr	A897	2	S	St	aul		C	1	T
300	EB	V/Gr	A897		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
301	EB	V/Gr	A897		S	Tb	fav	<i>Paleofavosites</i>	T	0	
302	EB	V/Gr	A897		S	Tb	fav	<i>Paleofavosites</i>	L	0	
1008	EB	Gr	A210		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
1616	EB	Gr	A316	1	S	St	aul		C	0	
1618	EB	Gr	A316	2	S	St	aul		C	0	
1619	EB	Gr	A316	3	S	St	aul		C	0	
1617	EB	Gr	A316	2	S	Tb	hel	<i>Ellisites labechioides</i>	D	2	T
409	EB	Gr	A359-8		M	Tb	fav	<i>Paleofavosites</i>	D	2	T
297	EB	Gr	A425		M	Tb	fav	<i>Paleofavosites</i>	L	0	
299	EB	Gr	A426		M	Tb	sar	<i>Calapoecia</i>	D	2	T
1613	EB	Gr	A493		M	St	aul		C	0	
1028	EB	Gr	A496		S	Tb	fav	<i>Paleofavosites</i>	H	0	
442	EB	Gr	A496		S	Tb	hel	<i>Ellisites</i>	T	1	T
443	EB	Gr	A496		S	Tb	hel	<i>Ellisites</i>	T	2	T
444	EB	Gr	A496		S	Tb	hel	<i>Ellisites</i>	T	1	T
445	EB	Gr	A496		S	Tb	hel	<i>Ellisites</i>	L	1	T

446	EB	Gr	A496		S	Tb	hel	<i>Ellisites</i>	T	0	
447	EB	Gr	A496		S	Tb	hel	<i>Ellisites</i>	T	2	T
449	EB	Gr	A496		S	Tb	hel	<i>Ellisites</i>	S	1	T
425	EB	Gr	A496G	2	S	Tb	fav	<i>Paleofavosites</i>	D	2	T
1614	EB	Gr	A540		M	St	aul		C	2	T
1615	EB	Gr	A540		M	St	aul		C	1	T
1053	EB	Gr	A540		M	Tb	fav	<i>Paleofavosites</i>	D	2	T
314	EB	Gr	A591	2	S	Tb	fav	<i>Paleofavosites</i>	L	0	
315	EB	Gr	A591	17	S	Tb	fav	<i>Paleofavosites</i>	D	0	
322	EB	Gr	A591	1	S	Tb	fav	<i>Paleofavosites</i>	L	0	
325	EB	Gr	A591	3	S	Tb	fav	<i>Paleofavosites</i>	L	0	
328	EB	Gr	A591	14	S	Tb	fav	<i>Paleofavosites</i>	L	0	
339	EB	Gr	A591	5	S	Tb	fav	<i>Paleofavosites</i>	L	0	
341	EB	Gr	A591	4	S	Tb	fav	<i>Paleofavosites</i>	L	0	
342	EB	Gr	A591	13	S	Tb	fav	<i>Paleofavosites</i>	L	0	
343	EB	Gr	A591	11	S	Tb	fav	<i>Paleofavosites</i>	L	0	
344	EB	Gr	A591	8	S	Tb	fav	<i>Paleofavosites</i>	D	0	
345	EB	Gr	A591	9	S	Tb	fav	<i>Paleofavosites</i>	L	0	
346	EB	Gr	A591	28	S	Tb	fav	<i>Paleofavosites</i>	D	0	
348	EB	Gr	A591	18	S	Tb	fav	<i>Paleofavosites</i>	L	0	
350	EB	Gr	A591	15	S	Tb	fav	<i>Paleofavosites</i>	D	0	
351	EB	Gr	A591	24	S	Tb	fav	<i>Paleofavosites</i>	L	0	
353	EB	Gr	A591	34	S	Tb	fav	<i>Paleofavosites</i>	L	0	
340	EB	Gr	A591	5	S	Tb	hel	<i>Ellisites astomata</i>	T	0	
347	EB	Gr	A591	25	S	Tb	hel	<i>Propora conferta</i>	L	1	T
349	EB	Gr	A591	22	S	Tb	sar	? <i>Calapoecia</i>	D	0	
352	EB	Gr	A591	29	S	Tb	sar	<i>Columnopora</i>	D	0	
1621	EB	Gr	A591b		S	St	aul		C	1	T
316	EB	Gr	A591b	18	S	Tb	fav	<i>Paleofavosites</i>	D	0	
317	EB	Gr	A591b		S	Tb	fav	<i>Paleofavosites</i>	D	0	
318	EB	Gr	A591b	25	S	Tb	fav	<i>Paleofavosites</i>	L	0	
319	EB	Gr	A591b	16	S	Tb	fav	<i>Paleofavosites</i>	D	0	
320	EB	Gr	A591b	23	S	Tb	fav	<i>Paleofavosites</i>	H	1	T
321	EB	Gr	A591b	26	S	Tb	fav	<i>Paleofavosites</i>	L	0	
323	EB	Gr	A591b	13	S	Tb	fav	<i>Paleofavosites</i>	D	0	
324	EB	Gr	A591b	4	S	Tb	fav	<i>Paleofavosites</i>	D	0	
326	EB	Gr	A591b	21	S	Tb	fav	<i>Paleofavosites</i>	L	0	
327	EB	Gr	A591b	3	S	Tb	fav	<i>Paleofavosites</i>	L	1	T
329	EB	Gr	A591b	1	S	Tb	fav	<i>Paleofavosites</i>	L	0	
331	EB	Gr	A591b	3	S	Tb	fav	<i>Paleofavosites</i>	T	2	T
334	EB	Gr	A591b	1.1	S	Tb	fav	<i>Paleofavosites</i>	D	0	
335	EB	Gr	A591b	4	S	Tb	fav	<i>Paleofavosites</i>	D	1	T
336	EB	Gr	A591b	6	S	Tb	fav	<i>Paleofavosites</i>	T	0	
337	EB	Gr	A591b	8	S	Tb	fav	<i>Paleofavosites</i>	H	0	
338	EB	Gr	A591b	7	S	Tb	fav	<i>Paleofavosites</i>	L	1	T
298	EB	Gr	A591b	24	S	Tb	sar	<i>Columnopora</i>	L	0	
330	EB	Gr	A591b	5	S	Tb	sar	? <i>Calapoecia</i>	D	1	T
332	EB	Gr	A591b	2	S	Tb	sar	<i>Columnopora</i>	H	1	T
333	EB	Gr	A591b	6	S	Tb	sar	<i>Columnopora</i>	D	1	T
1502	EB	Gr	A897		S	St	aul		C	1	T
1543	EB	Gr	A897	8	M	St	aul		C	1	T
1555	EB	Gr	A897	15	M	St	aul		C	0	
1569	EB	Gr	A897	6	M	St	aul		C	1	T
1574	EB	Gr	A897	14	M	St	aul		C	1	T
1575	EB	Gr	A897	13	M	St	aul		C	1	T

1579	EB	Gr	A897	12	M	St	aul		C	0	
1581	EB	Gr	A897	17	M	St	aul		C	1	T
1612	EB	Gr	A897	10	M	St	aul		C	1	T
1663	EB	Gr	A906		S	St	aul		C	0	
1664	EB	Gr	A906		S	St	aul		C	1	T
1665	EB	Gr	A906		S	St	aul		C	2	T
1666	EB	Gr	A906		S	St	aul		C	2	T
1667	EB	Gr	A906		S	St	aul		C	0	
1668	EB	Gr	A906		S	St	aul		C	0	
1669	EB	Gr	A906		S	St	aul		C	0	
1670	EB	Gr	A906		S	St	aul		C	3	T
1671	EB	Gr	A906		S	St	aul		C	0	
1672	EB	Gr	A906	7	S	St	aul		C	0	
1673	EB	Gr	A906	11	S	St	aul		C	0	
1674	EB	Gr	A906		S	St	aul		C	1	T
1675	EB	Gr	A906	1	S	St	aul		C	1	T
1676	EB	Gr	A906	4	S	St	aul		C	1	T
1677	EB	Gr	A906	9	S	St	aul		C	0	
1678	EB	Gr	A906	5	S	St	aul		C	1	T
1679	EB	Gr	A906	13	S	St	aul		C	2	T
1680	EB	Gr	A906	8	S	St	aul		C	3	T
1681	EB	Gr	A906	2	S	St	aul		C	1	T
1682	EB	Gr	A906	10	S	St	aul		C	0	
1683	EB	Gr	A906	9	S	St	aul		C	0	
1684	EB	Gr	A906	3	S	St	aul		C	2	T
1685	EB	Gr	A906	6	S	St	aul		C	0	
1566	EB	Gr	A951a	1	M	St	aul		C	1	T
1634	EB	Gr	A951a		M	St	aul		C	0	
313	EB	Gr	A951a		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
448	EB	?Gr	A496		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
1006	EB	?Gr	A496		S	Tb	hel	<i>Ellisites labechioides</i>	M	2	T
450	EB	?Gr	A496e?		S	Tb	fav	<i>Paleofavosites</i>	L	1	T
1606	V	SC	A1193		M	St	aul		C	1	T
1609	V	SC	A1193		M	St	aul		C	1	T
34	V	SC	A1193		M	Tb	fav	<i>Paleofavosites</i>	L	1	T
1748	V	SC	A211		M	St	aul		C	2	T
41	V	SC	A211		S	Tb	fav	<i>Paleofavosites</i>	L	0	
42	V	SC	A211		S	Tb	fav	<i>Paleofavosites</i>	L	0	
37	V	SC	A364		M	Tb	fav	<i>Paleofavosites</i>	L	1	T
35	V	SC	A364		M	Tb	hel	<i>Ellisites astomata</i>	D	4	T
36	V	SC	A364		M	Tb	hel	<i>Ellisites astomata</i>	L	4	T
38	V	SC	A364		M	Tb	hel	<i>Propora conferta</i>	S	1	T
39	V	SC	A364		M	Tb	hel	<i>Ellisites astomata</i>	L	4	T
1825	V	SC	A364-1		M	St	aul		C	1	T
1826	V	SC	A364-1		M	St	aul		C	0	
201	V	MB	A1261		S	Tb	fav	<i>Paleofavosites</i>	T	0	
171	V	MB	A1261		S	Tb	sar	? <i>Columnopora</i>	H	0	
43	V	MB	A1262		S	Tb	sar	? <i>Calapoecia</i>	L	1	T
44	V	MB	A1262		S	Tb	sar	? <i>Calapoecia</i>	H	1	T
45	V	MB	A1263		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
185	V	MB	A1263		S	Tb	fav	<i>Paleofavosites</i>	L	1	T
186	V	MB	A1263		S	Tb	fav	<i>Paleofavosites</i>	L	0	
187	V	MB	A1263		S	Tb	fav	<i>Paleofavosites</i>	L	1	T
188	V	MB	A1263		S	Tb	sar	<i>Calapoecia</i>	L	0	
1045	V	MB	A1399		R	St	—	?	L	0	

180	V	MB	A1399		R	Tb	hel	<i>Ellisites labechioides</i>	D	0	
275	V	MB	A1399		R	Tb	hel	<i>Propora conferta</i>	D	0	
276	V	MB	A1399		R	Tb	hel	<i>Propora conferta</i>	D	1	T
1044	V	MB	A1399	12	R	Tb	hel	<i>Ellisites labechioides</i>	M	1	T
1382	V	MB	A1399		R	Tb	hel	<i>Ellisites labechioides</i>	M	0	
1383	V	MB	A1399		R	Tb	hel	<i>Ellisites labechioides</i>	L	0	
40	V	MB	A1399	2	R	Tb	sar	<i>Columnopora</i>	D	2	C
1048	V	MB	A1399	30	R	Tb	sar	<i>Columnopora</i>	D	2	C
1051	V	MB	A1399		R	Tb	sar	<i>Columnopora</i>	D	2	C
167	V	MB	A14		R	St	aul		C	0	
1806	V	MB	A14	8	R	St	aul		C	1	T
1807	V	MB	A14	2	R	St	aul		C	1	T
1808	V	MB	A14	1	R	St	aul		C	0	
1809	V	MB	A14	11	R	St	aul		C	1	T
1810	V	MB	A14	10	R	St	aul		C	0	
1811	V	MB	A14	5	R	St	aul		C	1	T
1034	V	MB	A14		R	Tb	fav	<i>Paleofavosites</i>	T	0	
169	V	MB	A14		R	Tb	hel	<i>Ellisites labechioides</i>	T	0	
200	V	MB	A14		R	Tb	hel	<i>Ellisites labechioides</i>	M	0	
166	V	MB	A14		R	Tb	sar	<i>Columnopora</i>	H	1	T
168	V	MB	A14		R	Tb	sar	<i>Columnopora</i>	D	0	
1035	V	MB	A14		R	Tb	sar	<i>Columnopora</i>	H	2	C
451	V	MB	A203		R	Tb	hel	<i>Protochiscolithus</i>	D	3	T
452	V	MB	A203		R	Tb	hel	<i>Protochiscolithus</i>	L	0	
1812	V	MB	A205		S	St	aul		C	0	
1817	V	MB	A206	1	S	St	aul		C	1	T
1818	V	MB	A206	2	S	St	aul		C	1	T
1813	V	MB	A207	1	S	St	aul		C	1	T
1814	V	MB	A207	2	S	St	aul		C	0	
1815	V	MB	A207	3	S	St	aul		C	1	T
51	V	MB	A208		S	Tb	sar	? <i>Calapoecia</i>	H	1	T
311	V	MB	A208		S	Tb	sar	? <i>Columnopora</i>	H	1	T
50	V	MB	A365	7	S	Tb	sar	? <i>Calapoecia</i>	D	1	T
49	V	MB	A365a	1	S	St	—	? <i>Ecclimadictyon</i>	H	3	T
199	V	MB	A365a		S	Tb	fav	<i>Paleofavosites</i>	L	3	T
46	V	MB	A365a		S	Tb	hel	<i>Ellisites labechioides</i>	T	1	T
47	V	MB	A365a	2	S	Tb	hel	<i>Ellisites labechioides</i>	M	2	T
48	V	MB	A365a		S	Tb	hel	<i>Ellisites labechioides</i>	L	4	T
60	V	MB	A365a		S	Tb	hel	<i>Ellisites labechioides</i>	L	4	T
61	V	MB	A365a		S	Tb	hel	<i>Ellisites labechioides</i>	L	3	T
62	V	MB	A365a		S	Tb	hel	<i>Ellisites labechioides</i>	L	3	T
63	V	MB	A365a		S	Tb	hel	<i>Ellisites labechioides</i>	L	5	T
64	V	MB	A365a		S	Tb	hel	<i>Ellisites labechioides</i>	L	0	
65	V	MB	A365a		S	Tb	hel	<i>Ellisites labechioides</i>	L	2	T
197	V	MB	A365a	1	S	Tb	hel	<i>Protochiscolithus</i>	D	4	T
198	V	MB	A365a	3	S	Tb	hel	<i>Protochiscolithus</i>	L	2	T
1816	V	MB	A491		S	St	aul		C	0	
1744	V	MB	A492-3		S	St	aul		C	0	
1745	V	MB	A492-3		S	St	aul		C	1	T
1746	V	MB	A492-3		S	St	aul		C	0	
1780	V	MB	A5		R	St	aul		C	0	
1781	V	MB	A5		R	St	aul		C	0	
1782	V	MB	A5	2	R	St	aul		C	0	
1783	V	MB	A5	6	R	St	aul		C	0	
1784	V	MB	A5	4	R	St	aul		C	0	

1785	V	MB	A5	14	R	St	aul		C	1	T
1786	V	MB	A5	7	R	St	aul		C	0	
1787	V	MB	A5	15	R	St	aul		C	0	
1788	V	MB	A5	10	R	St	aul		C	0	
1789	V	MB	A5		R	St	aul		C	0	
1790	V	MB	A5	12	R	St	aul		C	1	T
1791	V	MB	A5	5	R	St	aul		C	0	
56	V	MB	A5		R	Tb	fav	<i>Paleofavosites</i>	H	0	
170	V	MB	A5		R	Tb	fav	? <i>Paleofavosites</i>	T	0	
54	V	MB	A5		R	Tb	hel	<i>Propora conferta</i>	L	1	T
53	V	MB	A5		R	Tb	sar	? <i>Calapoecia</i>	D	0	
55	V	MB	A5		R	Tb	sar	? <i>Calapoecia</i>	L	1	T
57	V	MB	A5	y	R	Tb	sar	? <i>Calapoecia</i>	D	1	T
58	V	MB	A5	b	R	Tb	sar	? <i>Calapoecia</i>	D	0	
680	V	MB	A5		R	Tb	sar	? <i>Calapoecia</i>	D	1	T
16	V	MB	A587	13	M	Tb	fav	<i>Paleofavosites</i>	L	0	
20	V	MB	A587	3	M	Tb	fav	<i>Paleofavosites</i>	L	0	
17	V	MB	A587	11	M	Tb	sar	? <i>Calapoecia</i>	L	0	
18	V	MB	A587a		M	Tb	fav	<i>Paleofavosites</i>	L	0	
19	V	MB	A587a		M	Tb	fav	<i>Paleofavosites</i>	L	0	
21	V	MB	A587a		M	Tb	fav	<i>Paleofavosites</i>	T	0	
22	V	MB	A587a		M	Tb	fav	<i>Paleofavosites</i>	L	0	
1747	V	MB	A587b	1	S	St	aul		C	2	T
24	V	MB	A587b		S	Tb	fav	<i>Paleofavosites</i>	T	0	
25	V	MB	A587b		S	Tb	fav	<i>Paleofavosites</i>	L	1	T
26	V	MB	A587b		S	Tb	fav	<i>Paleofavosites</i>	T	1	T
27	V	MB	A587b		S	Tb	fav	<i>Paleofavosites</i>	L	1	T
28	V	MB	A587b		S	Tb	fav	?	L	2	T
29	V	MB	A587b		S	Tb	fav	<i>Paleofavosites</i>	T	0	
30	V	MB	A587b		S	Tb	fav	<i>Paleofavosites</i>	D	0	
31	V	MB	A587b		S	Tb	fav	<i>Paleofavosites</i>	D	0	
32	V	MB	A587b		S	Tb	fav	<i>Paleofavosites</i>	L	0	
33	V	MB	A587b		S	Tb	fav	<i>Paleofavosites</i>	L	1	T
1005	V	MB	A587b		S	Tb	fav	<i>Paleofavosites</i>	D	3	T
177	V	MB	A80		R	Tb	fav	<i>Paleofavosites</i>	L	2	T
178	V	MB	A80		R	Tb	fav	<i>Paleofavosites</i>	L	2	T
179	V	MB	A80		R	Tb	fav	<i>Paleofavosites</i>	D	0	
681	V	MB	A80		R	Tb	fav	<i>Paleofavosites</i>	T	0	
175	V	MB	A80		R	Tb	hel	<i>Propora conferta</i>	D	0	
176	V	MB	A80		R	Tb	hel	<i>Propora conferta</i>	D	0	
174	V	MB	A80		R	Tb	sar	<i>Calapoecia</i>	D	0	
1819	V	MB	A878b	1	S	St	aul		C	0	
1820	V	MB	A878b	7	S	St	aul		C	0	
1821	V	MB	A878b	10	S	St	aul		C	0	
1822	V	MB	A878b		S	St	aul		C	0	
1823	V	MB	A878b	9	S	St	aul		C	2	T
611	V	MB	A878b		S	St	—	<i>Pseudostylocidictyon</i>	L	1	T
612	V	MB	A878b		S	St	—	<i>Pseudostylocidictyon</i>	L	0	
172	V	MB	A878b		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
173	V	MB	A878b		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
202	V	MB	A878b		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
203	V	MB	A878b		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
204	V	MB	A878b		S	Tb	fav	<i>Paleofavosites</i>	D	0	
205	V	MB	A878b		S	Tb	fav	<i>Paleofavosites</i>	D	0	
1603	V	MB	A971c	4	S	St	aul		C	1	T

1604	V	MB	A971c	5	S	St	aul		C	1	T
1500	V	JP	A1165		M	St	aul		C	3	T
1601	V	JP	A204	2	S	St	aul		C	1	T
1733	V	JP	A204	1	S	St	aul		C	0	
1734	V	JP	A204	11	S	St	aul		C	0	
1735	V	JP	A204	3	S	St	aul		C	1	T
1736	V	JP	A204	14	S	St	aul		C	1	T
1737	V	JP	A204	13	S	St	aul		C	0	
1738	V	JP	A204	8	S	St	aul		C	1	T
1739	V	JP	A204	6	S	St	aul		C	0	
1740	V	JP	A204	10	S	St	aul		C	0	
1741	V	JP	A204	9	S	St	aul		C	0	
1742	V	JP	A204	4	S	St	aul		C	0	
1743	V	JP	A204	5	S	St	aul		C	1	T
258	V	JP	A204		S	Tb	fav	<i>Paleofavosites</i>	L	0	
1568	V	JP	A498	6	S	St	aul		C	3	T
1526	V	JP	A891	2	M	St	aul		C	0	
1527	V	JP	A891	51	M	St	aul		C	0	
1528	V	JP	A891	50	M	St	aul		C	1	T
1529	V	JP	A891	6	M	St	aul		C	0	
1530	V	JP	A891	4	M	St	aul		C	0	
1531	V	JP	A891	5	M	St	aul		C	1	T
1532	V	JP	A891		M	St	aul		C	1	T
1533	V	JP	A891	3	M	St	aul		C	0	
1554	V	JP	A891	6	M	St	aul		C	0	
1556	V	JP	A891	4	M	St	aul		C	0	
1558	V	JP	A891	1	M	St	aul		C	5	T
1559	V	JP	A891	8	M	St	aul		C	0	
1563	V	JP	A891	10	S	St	aul		C	0	
1564	V	JP	A891	13	S	St	aul		C	0	
1570	V	JP	A891	11	M	St	aul		C	1	T
1792	V	JP	A891		M	St	aul		C	0	
1793	V	JP	A891		M	St	aul		C	0	
1794	V	JP	A891		M	St	aul		C	0	
1795	V	JP	A891		M	St	aul		C	0	
1796	V	JP	A891		M	St	aul		C	0	
1797	V	JP	A891		M	St	aul		C	0	
1798	V	JP	A891	7	M	St	aul		C	0	
1799	V	JP	A891		M	St	aul		C	1	T
1800	V	JP	A891		M	St	aul		C	0	
1801	V	JP	A891		M	St	aul		C	0	
1802	V	JP	A891		M	St	aul		C	3	T
1803	V	JP	A891	5	M	St	aul		C	0	
1804	V	JP	A891	9	M	St	aul		C	1	T
1805	V	JP	A891	12	M	St	aul		C	0	
1750	V	H	A123	2	S	St	aul		C	3	T
1751	V	H	A123	1	S	St	aul		C	4	T
1611	V	H	A1331		M	St	aul		C	0	
232	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	D	0	
233	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
234	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	L	0	
235	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	D	0	
236	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	L	0	
237	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	D	0	
238	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	T	0	

239	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	D	0	
240	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	L	0	
241	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	D	0	
242	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
243	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	L	2	T
244	V	H	A1331		M	Tb	fav	<i>Paleofavosites</i>	D	1	T
1752	V	H	A2	5	M	St	aul		C	0	
1753	V	H	A2	4	M	St	aul		C	0	
1023	V	H	A35		M	Tb	sar	<i>Columnopora</i>	D	0	
1901	V	H	A406	1	M	St	aul		C	1	T
1761	V	H	A46	4	M	St	aul		C	1	T
1762	V	H	A46	3	M	St	aul		C	0	
1763	V	H	A46	1	M	St	aul		C	1	T
69	V	H	A480		M	Tb	fav	? <i>Paleofavosites</i>	S	1	T
1605	V	H	A486c	3	S	St	aul		C	1	T
1754	V	H	A912	1	S	St	aul		C	2	T
1755	V	H	A912	2	S	St	aul		C	0	
1756	V	H	A912	3	S	St	aul		C	0	
1757	V	H	A912		S	St	aul		C	0	
1758	V	H	A912		S	St	aul		C	0	
1759	V	H	A912		S	St	aul		C	2	T
1760	V	H	A912		S	St	aul		C	2	T
1764	V	H	A913	1	S	St	aul		C	0	
1765	V	H	A913	2	S	St	aul		C	0	
1766	V	H	A913	3	S	St	aul		C	0	
1767	V	H	A913		S	St	aul		C	0	
1768	V	H	A913		S	St	aul		C	2	T
1769	V	H	A913		S	St	aul		C	0	
1770	V	H	A913		S	St	aul		C	0	
1771	V	H	A913		S	St	aul		C	0	
1772	V	H	A913		S	St	aul		C	0	
1773	V	H	A913		S	St	aul		C	1	T
1774	V	H	A913		S	St	aul		C	1	T
1775	V	H	A913		S	St	aul		C	0	
1776	V	H	A913		S	St	aul		C	1	T
1777	V	H	A913		S	St	aul		C	0	
1778	V	H	A913		S	St	aul		C	0	
1779	V	H	A913		S	Tb	fav	<i>Paleofavosites</i>	H	0	
1493	V	H	A971a	4	S	St	aul		C	0	
1494	V	H	A971a	3	S	St	aul		C	0	
1538	V	H	A971a		S	St	aul		C	0	
1552	V	H	A971a		S	St	aul		C	0	
1561	V	H	A971a	13	S	St	aul		C	0	
1562	V	H	A971a	15	S	St	aul		C	0	
1567	V	H	A971a		S	St	aul		C	0	
1608	V	H	A971a		S	St	aul		C	0	
1582	V	H	A971b	2	S	St	aul		C	1	T
1551	V	H	A971c		S	St	aul		C	1	T
1553	V	H	A971c		S	St	aul		C	0	
1557	V	H	A971c	5	S	St	aul		C	0	
52	V	T	A535		S	Tb	fav	<i>Paleofavosites</i>	D	0	
1584	V	T/E	A129	3	M	St	aul		C	0	
1749	V	E	A297	1	S	St	aul		C	0	
260	?	?	?A1329		S	Tb	fav	<i>Paleofavosites</i>	D	1	T
261	?	?	?A1329		S	Tb	fav	<i>Paleofavosites</i>	D	1	T

APPENDIX C: NTS COORDINATES FOR SELECT LOCALITIES

<u>Locality</u>	<u>NTS</u>
A14	12E/14 73400:10850
A41	22H/16 00500:17220
A42	12E/11 69380:10130
A218	12F/5 80960:64680
A314	12F/5W 83450:63200
A363	12F/5 75100:66000
A429	22H/16 04210-330:16180-270
A436	22H/16 97680-720:17550-650
A554	12E/1 53180-300:34380-400
A590	12E/8 66520:68160
A734	12E/1 55270:54850
A759	12E/1 56400:54200
A764	12F/5 77680:57890
A835	12E/6 88300:81200
A846	12E/1 38400:54900
A961	12E/6 88220:81210
A1109c	12E/1 45280:55100
A1164	12E/1 38310:54730
A1175	22H/16 00280:17530
A1179	12E/1 43220:52300
A1188	12E/1 42950:51950
A1189	12E/1 42770:51750
A1191	12E/8 55810:72700
A1194	12E/8 49220:73950
A1204	12E/1 42350:48280
A1211	12E/1 42400:51370
A1271	12E/10 21730:87850
A1306	12E/1 45260:55010
A1360	12E/11 89490:91200
A1399	12E/14 73800:10750