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Rocky-Shore Biotic Associations and Their Fossilization Potential: Isla Requeson (Baja California Sur, Mexico)

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ABSTRACT

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What is the likelihood that biotic associations from a contemporary rocky-shore setting may find their way into the geologic record? Previous studies on fossilization potential have analyzed recent faunas on an inventory basis. This study considers the fate of intact biotic associations arrayed among 30 macrospecies of invertebrates and algae on a small island in Concepcion Bay, Baja California Sur, Mexico. Field data collected from a network of 15 transects and 66 census stations were subjected to R and Q-mode analyses in order to establish and map windward and leeward facies on the island.

Nearly all the species forming intertidal associations have hard parts which insure a high probability of fossilization, but 37–63% of the species in the adjoining shallow-subtidal zone have no chance or poor chances of fossilization. Species of *Sporolithon* and allied red coralline algae in the intertidal and shallow-subtidal zones play a key role by encrusting large surfaces and binding *in situ* associated fauna such as barnacles and the bivalve *Arca pacifica*. Burial of leeward rocky shores is already being effected due to the in-filling of a lagoon; future burial of windward rocky shores is possible due to the faulted structure of Concepcion Bay. Similar physical scenarios are known from the geologic record and they should afford a rich source of rocky-shore fossils for the study of community evolution.

ADDITIONAL INDEX WORDS: *Computer studies, R-mode and Q-mode analyses, windward and leeward biofacies, Gulf of California or Sea of Cortez.*

INTRODUCTION

Rocky-shore organisms constitute some of the world's most unique biotas. Special status derives from their habitation of a harsh environment at the interface between marine and terrestrial realms. The tremendous energy released by coastal waves is known to be indirectly harnessed by some organisms yielding high rates of biological productivity equal to or surpassing that of rain forests (LEIGH *et al.*, 1987). Although it is an attractive target of investigation, very little is known about the evolution of this efficient ecosystem through geologic time. An early review of limited data on ancient rocky shores emphasized the possible reasons for their scarcity in the geologic record (JOHNSON, 1988), but recent increases in the published data on this topic confirm that rocky shores are incorporated in the geologic record far more often than previously thought possible (JOHNSON, 1992). It is reasonable to study the evolution of the rocky-shore ecosystem only if rocky-shore organisms also find their way into the rock record with some degree of regularity.

Fossilization potential is an important approach to assessing the probability of reliable studies on community evolution of marine biotas in the context of geologic time. Some variations on this theme include the direct comparison of modern and ancient ecosystems (LAWRENCE, 1968; RUSSELL, 1991), the analysis of modern ecosystems only (CRAIG and JONES, 1966; SCHOPF, 1978), or the post-mortem history of fossil beds only (JOHNSON, 1960; VALENTINE, 1980). A recent study comparing modern and ancient death assemblages derived from high energy, rocky-shore environments was made by RUSSELL (1991); a summary therein (RUSSELL, 1991, Table 1) of 26 other studies in the modern/ancient mode reveals a total neglect of open coast, rocky shores. One of the first analyses of a modern intertidal rock fauna from the view point of fossilization potential was conducted by SCHOPF (1978), who predicted a minimum 30% loss of diversity due to nonfossilization. In contrast, the taphonomic study by

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VALENTINE (1980, p. 1313) of a Pleistocene terrace fauna dominated by intertidal, rocky-shore molluscs reflects a representation of "the entire intertidal zone" due to special conditions of post-mortem aggregation in the protected lee of a headland.

Most previous studies considering the fossilization potential of rocky-shore biotas agree, however, that inclusion in the rock record is an unusual occurrence. Although recent rock faunas from the Puget Sound area ranked higher in comparison to mud and sand faunas with respect to the number of genera expected to yield many identifiable fossils, SCHOPF (1978, p. 267) declared that "deposits of rocky shores are geologically rare." Despite favorable results from the Pleistocene record, VALENTINE (1980, pp. 1314–1315) concluded that "open coast shallow-water faunas are not generally common in the fossil record" because "the open coast environment is chiefly erosional rather than depositional, and . . . these nearshore sediments are among the first to be eroded." Essentially the same judgement was echoed by BAMBACH (1986, p. 412), who flatly excluded consideration of rocky-shore faunas in his otherwise far-reaching summary of marine-community diversification through Phanerozoic time.

The pioneer study by CRAIG and JONES (1966, p. 37) on the fossilization potential of recent subtidal faunas in the Irish Sea maintains that epifaunal species are more prone to post-mortem transport than infaunal species, but allows that "epifauna may be found *in situ* in isolated cases in the geological record, principally at unconformities or disconformities or in bioherms." Not all unconformities are indicative of ancient rocky shores and CRAIG AND JONES (1966) explicitly referred to submarine conditions. The opposite rule remains valid, however, that "all ancient rocky shores are represented in the geologic record by unconformities" (JOHNSON, 1992, p. 798). The main purpose of this contribution is to assess the fossilization potential of some rocky-shore associations which are largely intertidal in nature on a small island closely situated to the mainland of Baja California in the Gulf of California. Unlike any of the others cited here, this study focuses on modern biotas which are densely packed on rock surfaces in an intergraded blanket of well defined zones. What are the chances that this zoned intertidal biota will find its way *in situ* into the geologic record on a possible unconformity surface?

LOCATION, GEOLOGIC SETTING, AND PRODUCTIVITY

Isla Requeson in Concepcion Bay (Figure 1A) is a rocky island less than a kilometer in length attached by a 350 m-long tombolo to the mainland of Baja California Sur. The distal end of the tombolo is submerged daily by high tides with a range of 2.75 m. Access to the tombolo is by way of Mexican Federal Highway 1 between kilometer markers 93 and 92, 42 km south of Mulegé (Figure 1B). The island is blocked from the open Gulf of California by Concepcion Peninsula, which with the mainland forms a prominent northwest-facing bay roughly 37 km long and 3–5 km wide. Concepcion Bay is situated on the east coast of Baja California, a little more than halfway down the Gulf of California (Figure 1C).

The Concepcion Bay area was mapped geologically by MCFALL (1968), who detected a major northwest-trending fault zone running down the bay close to and crossing the margin of Concepcion Peninsula. Geomorphological evidence for the emplacement of a continuous, wide alluvial fan along the inside margin of Concepcion Peninsula strongly suggests that the bay formed through the development of horst and graben structures parallel to the Gulf of California. The entire region is dominated by over 4,000 m of Miocene volcanics belonging to the Comondú Group. Over 70% of the Isla Requeson shoreline is rocky, formed from eroded andesite flows, lahars, and tuffs. These rocks comprise the youngest part of the Comondú Group, assigned by MCFALL (1968) to the Ricason Formation.

Upwelling in the Gulf of California and tidal mixing with shallow coastal waters are conducive to the region's exceptionally high level of biological productivity (ALVAREZ-BORREGO and LARA-LARA, 1991). Winds tend to blow out of the north, particularly during the winter months (MERRIFIELD *et al.*, 1987), and this factor helps blend nutrient-rich waters with the shallow waters of Concepcion Bay. Isla Requeson's very name is an allusion to the spot's tremendous productivity. In Spanish, the word *requeson* refers to "curdled milk" or cottage cheese. Extensive rhodolith beds composed of spherical coralline algae occur offshore. These red algae have a lumpy, pustular appearance. When they wash ashore they are bleached white, looking much like cottage cheese. More importantly, the crushed rhodoliths provide a major source of calcareous sand forming

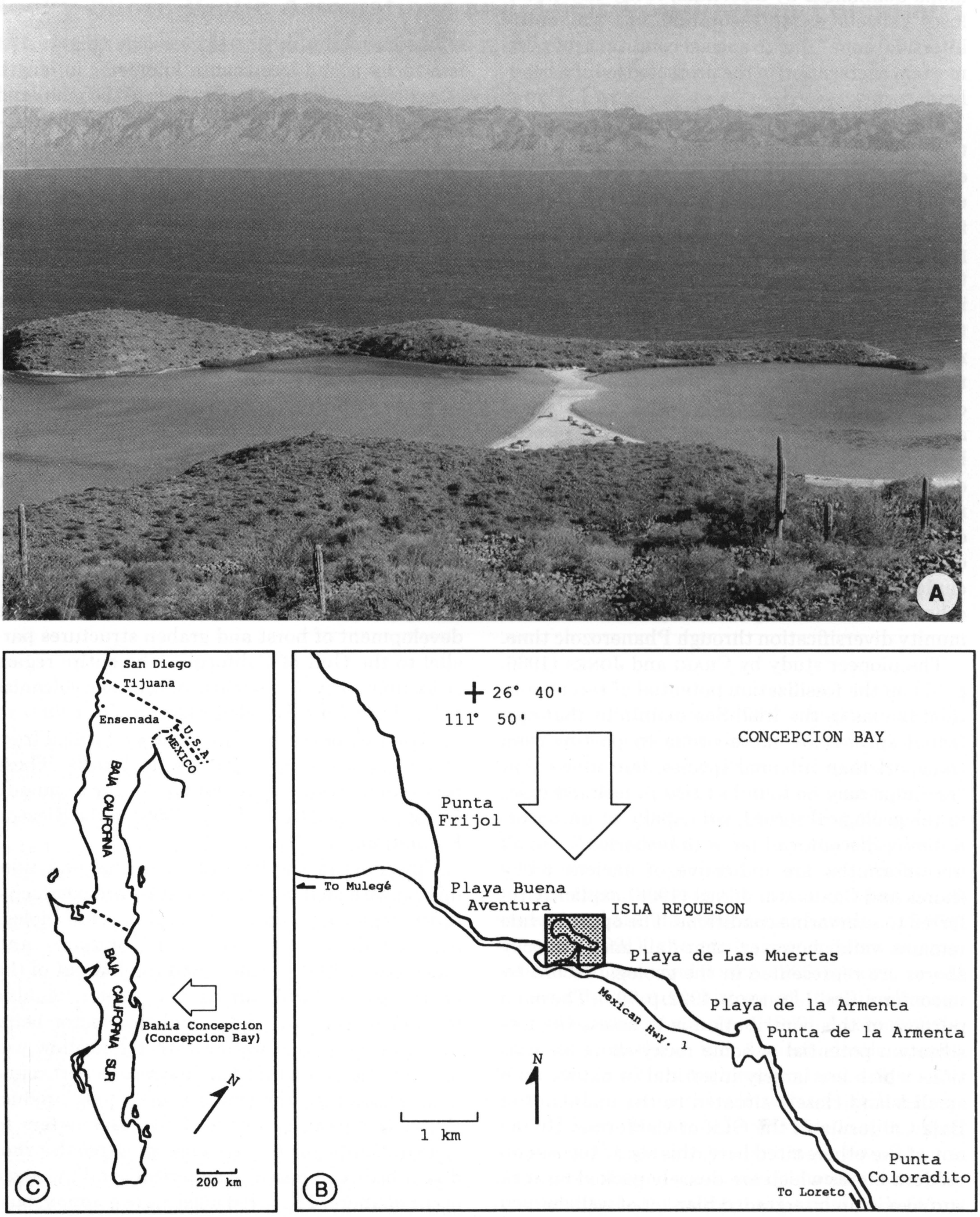

Figure 1. A. View of Isla Requeson looking northeast with tombolo in the foreground, Concepcion Bay in the background, and Conception Peninsula in the far background. B. The immediate area around Isla Requeson. C. Map of Baja California and Baja California Sur, showing the position of Concepcion Bay on the Gulf of California.

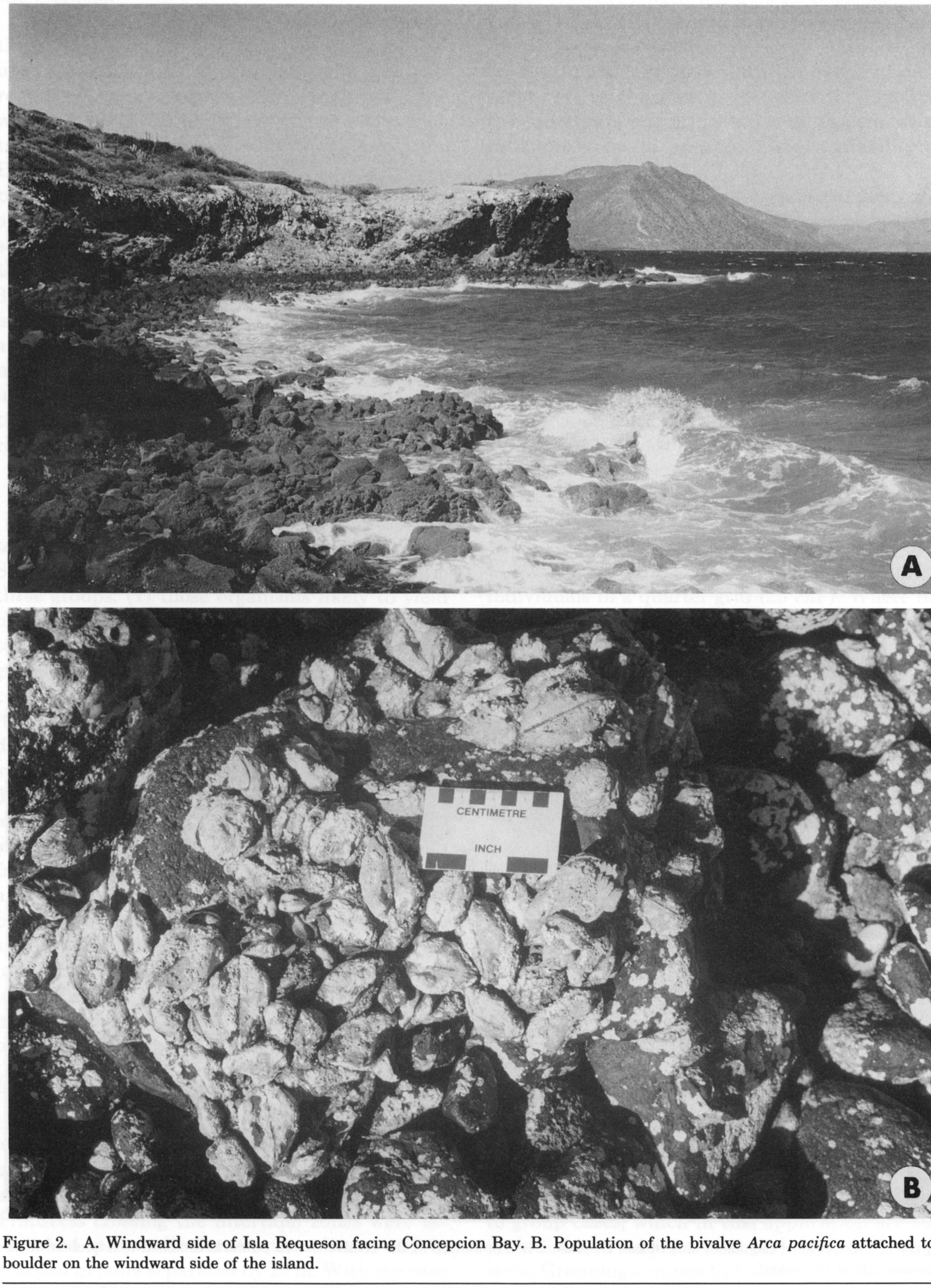

Figure 2. A. Windward side of Isla Requeson facing Concepcion Bay. B. Population of the bivalve *Arca pacifica* attached to a boulder on the windward side of the island.

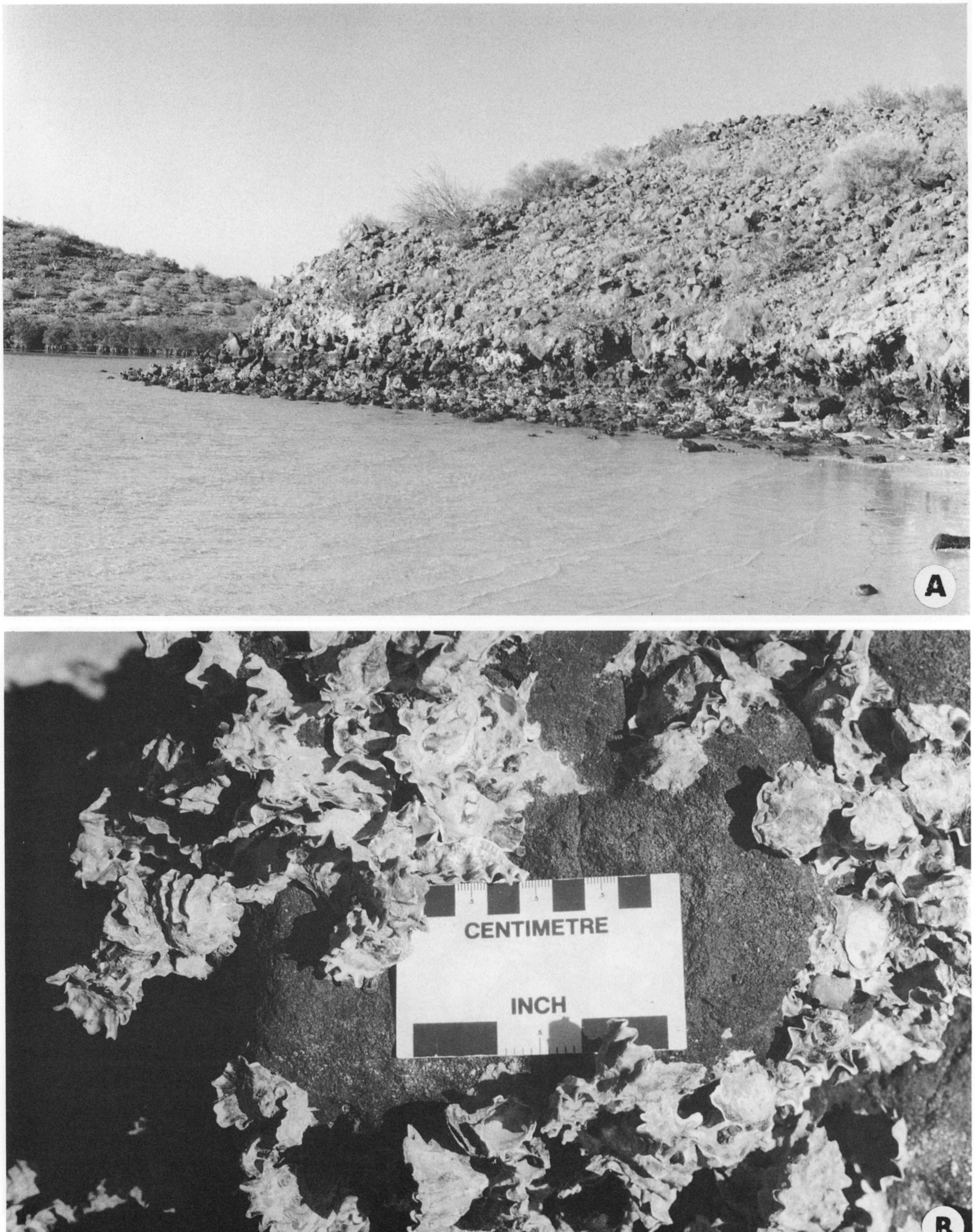

Figure 3. **A. Leeward (lagoonal) side of Isla Requeson. B. Population of the bivalve *Ostrea palmula* attached to a boulder on the leeward side of the island.**

the tombolo and filling in the shallow bays astride the tombolo.

Two major sub-environments are reflected by the placement of the island and its tombolo (Figure 1A) with respect to prevailing wind and current directions. The northeast-facing coast is the windward side of the island (Figure 2A), which takes the brunt of wave activity from Concepcion Bay. Especially prolific along this coast is *Arca pacifica*, the ark shell (Figure 2B), a bivalve firmly attached to rock surfaces by a strong byssus. The southwest-facing coast closer to the mainland is the protected, leeward side of the island (Figure 3A). *Ostrea palmula*, the rock oyster (Figure 3B), is an abundant bivalve cemented to rocky surfaces along this shore. These two bivalves are only the most conspicuous of at least 30 locally abundant invertebrate and algal macro-species belonging to the encrusting or clinging habitat of intertidal rocky shores.

METHODS

In this study, quantification of fossilization potential follows the basic approach employed by Schopf (1978) in differentiating a local biota into three groups: (1) those organisms likely to yield many fossils (Class I), (2) those organisms likely to yield some fossils (Class II), and (3) those organisms likely to yield no fossils (Class III). In conjunction with this part of the study, however, it was necessary to devise a plan to collect field data on the distribution of the common macro-species in their windward and leeward settings. These data were subsequently tested by computer analysis for patterns of zonation. The original study by Schopf (1978) concerning rock faunas from Puget Sound dealt with fossilization only on an inventory basis. Bridging field and computer phases, survey work was intended to establish the spacial relationships of the macro-species in terms of natural associations. The aim of this approach was not simply to determine what species might be preserved, but what *in situ* associations might be preserved in their characteristic dominance.

Intertidal Census Work

Once an adequate base map of Isla Requeson was made using the tape and compass method, intertidal census work could be initiated on a network of standard transects and sampling stations. Transects crossing the intertidal zones were established perpendicular to the shore, mainly grouped in pairs separated by 20 m. With the zero mark placed at the mean high tide mark, the maximum transect length was 17.5 m to the subtidal zone. Three sets of paired transects and one cluster of three transects were established on the windward coast. Another three sets of paired transects were established on the leeward coast. The transects were spaced in order to test trends at different scales in possible lateral variability of the biota.

Biological census data were collected along the transects at 2.5 m intervals, with as many as eight stations (A–H) on a 17.5 m transect. At each station, a standard quarter-meter quadrate divided into 10 × 10 cm grids was used to obtain species counts and relative abundances. Species identification conformed to the guide by Brusca (1980). All clinging, encrusting, cementing, or byssally attached organisms, living or dead, were counted. Mobile but hard-shelled invertebrates such as clinging gastropods also were included. Organisms on the sides and overhangs of boulders were recorded as if seen in a planar x-ray view. In most cases, species counts were tallied on an individual basis. Some, like barnacles, were so numerous that estimates had to be made based on a count of individuals in a quarter grid (25 cm^2). Where individual counts or estimates could not be performed, as with colonial anemones, corals, and algae, the percent cover within the grid was recorded. These raw data were used to construct area curves portraying the spacial variation in domination of key species on each of the 15 transects.

Computer Analyses

During the laboratory phase of this study, the NYSTS program for IBM personal computer performed cluster analyses in order to compare the relative abundances of species at each transect station. Both R-mode and Q-mode analyses were used to group the data according to similarity coefficients. R-mode analysis commonly is used to compare variables, which in this application are the 30 intertidal species found at Isla Requeson. The species were clustered as assemblages using the product-moment correlation coefficient. This coefficient quantitatively measures the degree to which two variables tend to fall on a straight line when plotted in two dimensions.

On the other hand, the Q-mode analysis is used to group cases, which in this application are the 66 individual stations scattered among 15 transects. Grouping stations by location follows trends

Table 1. *Taxonomic list of common intertidal organisms at Isla Requeson. Class I destination denotes those species likely to yield many fossils; Class II = some fossils; Class III = no fossils.*

Higher Taxa	Species	Fossilization Potential
Phylum Porifera		
Class Demospongiae		
Order Dictyoceratida		
Family Spongiidae	*Verongia aurea*	Class II
Phylum Coelenterata		
Subclass Zoantharia		
Order Actiniaria		
Family Actiniidae	*Anthopleura dowii*	Class III
Family Aiptasiidae	*Aiptasia californica*	Class III
Order Zoanthidea		
Family Zoanthidae	*Palythoa* sp.	Class III
Order Madreporaria		
Family Poritidae	*Porities californica*	Class I
Family Gorgoniidae	*Muricea californica*	Class II
Phylum Annelida		
Class Polychaeta		
Order Terebellida		
Family Serpulidae	*Spirorbis marioni*	Class I
Phylum Mollusca		
Class Bivalvia		
Subclass Pteriomorphia		
Order Arcoida		
Family Arcidae	*Arca pacifica*	Class I
Order Pterioida		
Family Pteriidae	*Pinctada mazatlanica*	Class I
Family Ostreidae	*Ostrea palmula*	
Subclass Heterodonta		
Order Veneroidea		
Family Carditidae	*Cardita affinis*	Class I
Family Chamidae	*Chama mexicana*	Class I
Class Gastropoda		
Subclass Prosobranchiata		
Order Archaeogastropoda		
Family Acmaeidae	*Collisella dalliana*	Class I
	Collisella stanfordiana	Class I
Family Turbinidae	*Turbo fluctuosus*	Class I
Family Neritidae	*Nerita funiculata*	Class I
Order Mesogastropoda		
Family Vermitidae	*Vermetus indentatus*	Class I
Family Cerithiidae	*Cerithium maculosum*	Class I
Family Calyptraeidae	*Crucibulum spinosum*	Class I
Family Muricidae	*Eupleura muriciformis*	Class I
Family Columbellidae	*Columbella strombiformis*	Class I
	Anachis coronata	Class I
	Mitrella guttata	Class I
Phylum Arthropoda		
Class Crustacea		
Subclass Cirripedia		
Order Thoracica		
Family Tetraclitidae	*Tetraclita affinis*	Class I
Family Balanidae	*Balanus* sp.	Class I
Kingdom Plantae		
Division Chlorophyta		
Order Ulotrichales		
Family Ulvaceae	*Ulva* sp.	Class III
Order Cladophorales		
Family Cladophoraceae	*Cladophora* sp.	Class II
Order Siphonales		
Family Bryopsidaceae	*Derbesia* sp.	Class III

Table 1. *Continued.*

Higher Taxa	Species	Fossilization Potential
Division Phaeophyta		
Order Dictyotales		
Family Dictyotaceae	*Dictyota* sp.	Class III
Division Rhodophyta		
Order Cryptonemiales		
Family Corallinaceae	*Sporolithon* sp.	Class I

and fluctuations in overall population size. The clustering is accomplished using a distance-cosine theta coefficient. Unlike the product-moment correlation coefficient in R-mode analysis, the Q-mode coefficient measures the angular relationship between two samples. The end result in terms of station groupings was assignment to upper-intertidal, mid-intertidal, low-intertidal, or shallow-subtidal zones. Dendograms are used effectively to express the results of these cluster analyses by species assemblages and physical zonation.

RESULTS

Listed in Table 1 are the 30 macro-species of intertidal invertebrates and algae common to Isla Requeson. Each species is labeled as characteristic of Class I, II, or III with respect to fossilization potential (SCHOPF, 1978). The Class I organisms likely to yield many fossils account for 70% of the biota (21 species). The Class II organisms include only three species, or 10% of the biota. Six species comprised of soft-tissue anemones and algae (or 20% of the biota) represent Class III with no chance of preservation. These results suggest a higher fossilization potential compared with the intertidal rock fauna from the Puget Sound area, where 30% of the fauna is not expected to fossilize and another 41% of the fauna is expected to yield few fossils (SCHOPF, 1978). The main difference between the two sets of data occurs in Class II, which for Isla Requeson included no motile arthropods (isopods and crabs).

Consideration of Area Curves

A sense of fixed relationships among sessile organisms was considered most important in our evaluation of fossilization potential. Two representative examples of changing domination among key sessile organisms within the intertidal zone are shown by area curves (Figure 4). Due to a wide range in species counts ranging from tens of thousands of *Balanus* sp. to less than 10 *Arca pacifica*, the abundance data were logarithmically transformed so that the graphs would be easily readable. An area curve representative of the windward side of the island (summation of transects 6 and 7) suggests a crude differentiation between a more landward zone dominated by species belonging to *Balanus*, *Ostrea*, and *Nerita* and a more seaward zone with species of *Sporolithon*, *Arca*, and *Palythoa* (Figure 4A). On the leeward side of the island (summation of transects 12 and 13), a crude differentiation is possible between a more landward zone dominated by species of *Bal-*

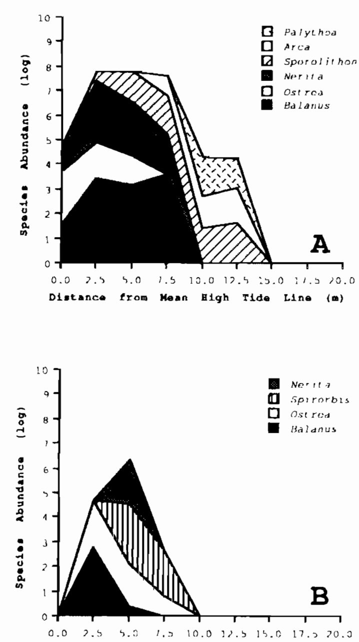

Figure 4. A. Area curve showing the relative abundances of key species on the windward side of Isla Requeson. B. Area curve showing the relative abundances of key species on the leeward side of Isla Requeson.

Table 2. *Intertidal biotic assemblages determined by R-mode analysis (see Figure 4).*

Rank	Species	Assem-blages	Preser-vation
1.	*Sporolithon sp.*	A	Class I
2.	*Cladophora* sp.		Class II
3.	*Arca pacifica*		Class I
4.	*Derbesia* sp.		Class III
5.	*Porities californica*		Class I
6.	*Dictyota* sp.		Class III
7.	*Verongia aurea*	B	Class II
8.	*Aiptasia californica*		Class III
9.	*Palythoa sp.*		Class III
10.	*Muricea californica*		Class II
11.	*Pinctada mazatlanica*		Class I
12.	*Ulva* sp.	C	Class III
13.	*Crucibulum spinosum*		Class I
14.	*Spirorbis marioni*		Class I
15.	*Cardita affinis*		Class I
16.	*Columbella strombiformis*		Class I
17.	*Anthopleura dowii*		Class III
18.	*Anachis coronata*		Class I
19.	*Ostrea palmula*	D	Class I
20.	*Vermetus indentatus*		Class I
21.	*Collisella dalliana*		Class I
22.	*Cerithium maculosum*		Class I
23.	*Collisella stanfordiana*		Class I
24.	*Chama mexicana*	E	Class I
25.	*Balanus sp.*		Class I
26.	*Nerita funiculata*		Class I
27.	*Tetraclita affinis*		Class I
28.	*Eupleura muriciformis*		Class I
29.	*Turbo fluctuosus*		Class I
30.	*Mitrella guttata*		Class I

anus and a more seaward zone with species of *Ostrea*, *Spirorbis*, and *Nerita* (Figure 4B).

Two distinctions between windward and leeward facies are clear from these preliminary data. There is some difference in diversity, with the windward side supporting seven dominant species and the leeward side only four. The zones on opposite sides of the island also differ in expansiveness. Those on the windward side extend 15 m to the shallow subtidal, while the leeward zones (lagoonal side of the island) terminate at roughly 10 m. These relationships are put into much better focus through the results of the computer analyses dealing with many more variables.

Interpretation of Dendograms

The dendograms resulting from R-mode and Q-mode analyses may be studied individually or in a cross-referenced matrix (Figure 5). They may also be considered in light of the entire set of raw data. Natural assemblages of rocky-shore species are delineated by the R-mode dendogram appended on the left side of the matrix. The numbers 1–30 along the edge of the dendogram refer to the 30 species of common intertidal invertebrates and algae at Isla Requeson. To conserve space for the matrix, the names of these species are repeated in Table 2, as ordered in the dendogram. The R-mode dendogram lends itself to a differentiation of five biotic assemblages, which are statistically observed to cluster together. The nearest neighbors listed in bold print (Table 2) represent the most dominant organisms within a given assemblage and they provide their names to the assemblages. The five are the *Sporolithon* sp.-*Arca pacifica* assemblage, the *Aiptasia californica*–*Palythoa* sp. assemblage, the *Crucibulum spinosum*-*Spirorbis marioni* assemblage, the *Ostrea palmula*–*Vermetus indentatus* assemblage, and the *Balanus* sp.-*Nerita funiculata* assemblage. Each of these assemblages consists of between five and seven members (Table 2, A–E).

In the dendogram derived from Q-mode analysis found at the top of the matrix (Figure 5), individual stations are clustered according to locations sharing comparable total counts of individuals by species. This was accomplished independent of species identification. Each of the 66 stations is identified by a number and a letter. Station 6A, for example, is situated on transect 6 at the zero mark (mean high tide level); station 6C is on the same transect 5 m seaward (two 2.5 m intervals away). The dendogram indicates that station 6A is more like 7A than any of the other 64 stations, while station 6C is most like station 7B. This is not very surprising, since these pairs were only 20 m apart laterally along the windward coast of Isla Requeson. By looking for breaks among the cases signified by their more distal relationships, it is possible to separate the stations into four distinct zones. The boundaries between these zones are demarcated by three vertical lines which extend through the dendogram separating regions assigned to the upper-intertidal, mid-intertidal, low-intertidal and shallow-subtidal zones (Figure 5). Generally, the upper-intertidal zone consists of transect stations A through C, while the shallow subtidal zone at the other end consists of transect stations E through H. The shallow-subtidal zone also shows a minor subdivision, as indicated by the dashed vertical line to the far right of the dendogram.

The matrix formed by the two dendograms helps

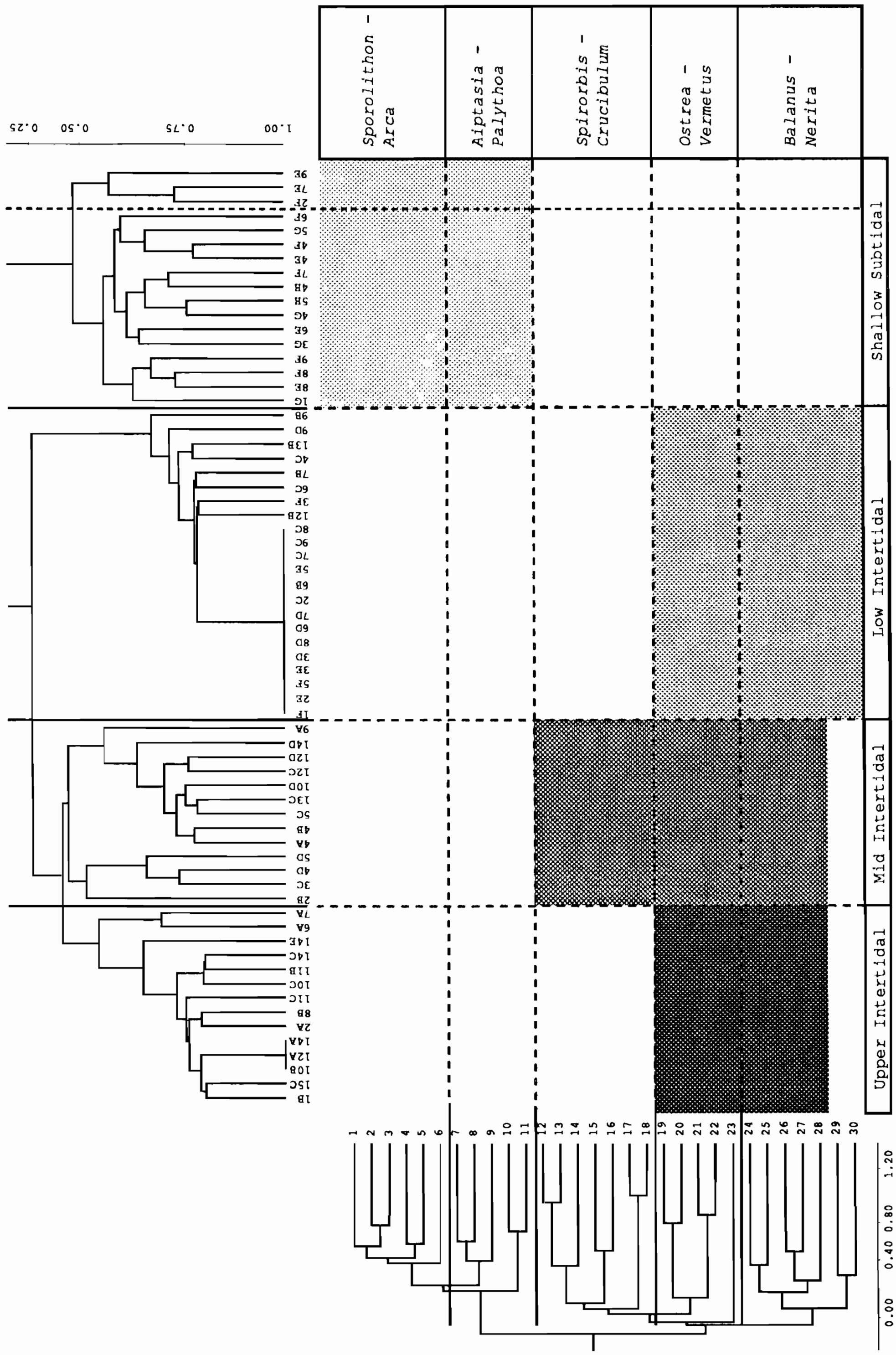

Figure 5. Matrix formed by dendograms from R-mode analysis distinguishing biotic assemblages (left and right sides of the diagram) and Q-mode analysis distinguishing intertidal and subtidal zones (top and bottom sides of the diagram). The species corresponding to the numbers found on the R-mode dendogram are listed in Table 2. The number-letter combinations found on the Q-mode dendogram correspond to transects and census stations.

one-third in comparison to the length of transects attained on the windward side of the island. The shortness of the leeward transects is due entirely to the fact that the lagoon is filling with sediment. The transects were ended at about 10 m because that is where the transition to lagoonal sediments occurred. As the tombolo is transformed into a permanent land connection, the lagoonal rocky shore will continue to be buried.

Due to the special geological factors involved in the formation of Concepcion Bay, the windward side of Isla Requeson also has the potential for eventual burial. As noted by McFALL (1968, p. 16), the eastern side of the bay along Concepcion Peninsula is traced by a wide, laterally extensive alluvial fan, or bajada (background, Figure 1A). This feature was interpreted as part of the scarp belonging to the main Concepcion Bay fault. No equivalent bajada occurs on the western shore of the bay, where rocky shores tend to be very steep. This discrepancy implies that another fault with greater vertical slippage runs along the western shore and that the graben floor of Concepcion Bay slopes downward to the west (MINCH and LESLIE, 1991, p. 122). The bajada represents a considerable progradation of terrestrial sediments and with enough time the entire bay could be filled. A different possibility assuming future translational movement along the main fault, is for the entire Concepcion Peninsula to be shifted offshore as an island. In that case, Isla Requeson would be exposed to the open Gulf of California.

Examples of fault-bound rocky islands or rocky coasts consistent with the burial scenario outlined here do exist in the geological literature. Horst and graben movements in the Mishrif carbonates of northwestern Oman produced Cretaceous islands with rocky shores paved by conglomerates (HARRIS and FROST, 1984, p. 657). Similar conglomerate-draped rocky shores were developed on faulted and tilted basement blocks during the Miocene on the Gulf of Suez (BURCHETTE, 1988, p. 199). These examples share in common a present arid climate, where unconformities are well exposed. The novelty of ancient rocky shores is not so much in their rarity, but in the confirmation of places where they are expected to be well preserved and well exposed (JOHNSON, 1988).

Encrusting coralline and calcareous algae should be one of the most common binding elements preserved on ancient rocky shores. Algal cements of Miocene age were detected on fracture walls in the basement rocks studied by BURCHETTE (1988, p. 189) in the Gulf of Suez region. Encrusting calcareous algae is illustrated by READ and GROVER (1977, p. 959) on an Ordovician karst shore from Virginia. A red coralline alga is illustrated by BROOKFIELD and BRETT (1988, p. 95) on an Ordovician granite shore from Ontario. The genus *Sporolithon* from Isla Requeson is equated by WOELKERLING (1988) to the genus *Archaeolithothamnium,* which has an extensive fossil record. None of the sources on this primitive red algae reviewed by JOHNSON (1963) seem to have been preserved in rocky-shore environments. An outstanding rocky-shore locality with prodigious *Sporolithon* and an associated fauna of Cretaceous age is currently being described from Baja California.

CONCLUSIONS

Despite the prevailing sense of opinion that rocky-shore biotas have little chance of being preserved in the geologic record (SCHOPF, 1978; VALENTINE, 1980; and BAMBACH, 1986), their fossilization potential is considered relatively high on a species-by-species basis. Special conditions of post-mortem transport and burial are sometimes cited as responsible for unusual cases of preservation (VALENTINE, 1980). This study demonstrates the advantage of looking at fossilization potential in terms of the *in situ* preservation of rocky-shore associations. Sessile species, in particular, utilize a variety of clinging, encrusting, and boring strategies to stay put on high-energy rocky shores. In order to be found as fossils in their living position, these organisms must be buried in place on an unconformity surface. Fault-bounded rocky islands and rocky shorelines provide one important avenue of burial and conditions of rapid transgression constitute another.

Isla Requeson provides a realistic model of how a rich rocky-shore biota potentially could be incorporated into the geologic record. The principle findings of this study on the possible fossilization of rocky-shore biotic associations are as follows:

(1) A relatively diverse group of 30 invertebrate and algae macro-species occupy the rocky shores of Isla Requeson, in Baja California Sur. These species are readily divided by standard techniques of field and computer analysis into assemblages and associations which differentiate windward (open circulation) and leeward (lagoonal) habitats.

(2) On a species-by-species basis, 70–80% of

the 30 macro-species possess the requisite hard parts to become fossilized.

(3) Considered in terms of their natural associations, nearly the entire intertidal zone has a high probability of fossilization. The immediately adjacent shallow-subtidal zone suffers the greatest potential information loss, with 37–63% of the macro-species subject to non-preservation.

(4) A key encrusting and binding element widely distributed in the intertidal and shallow-subtidal zones is the coralline red algae *Sporolithon* (and its allies). Other encrusters and binders such as mat anemones have no chance of preservation, but the coralline red algae may be readily fossilized and hold associated faunal elements in place after death.

(5) Burial of the leeward rocky shores on Isla Requeson is already in progress due to the filling of the lagoon by a tremendous volume of biologically derived sediments. The fault-controlled nature of Concepcion Bay may eventually lead to burial of the windward rocky shores by progradation of terrestrial sediments.

Ancient counterparts to Isla Requeson, in terms of fault-bounded rocky islands and rocky shorelines, are already known to exist in the geologic record (HARRIS and FROST, 1984; BURCHETTE, 1988). Geologists and paleontologists must be trained and educated to anticipate the preservation of rocky-shore biotas in such settings.

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