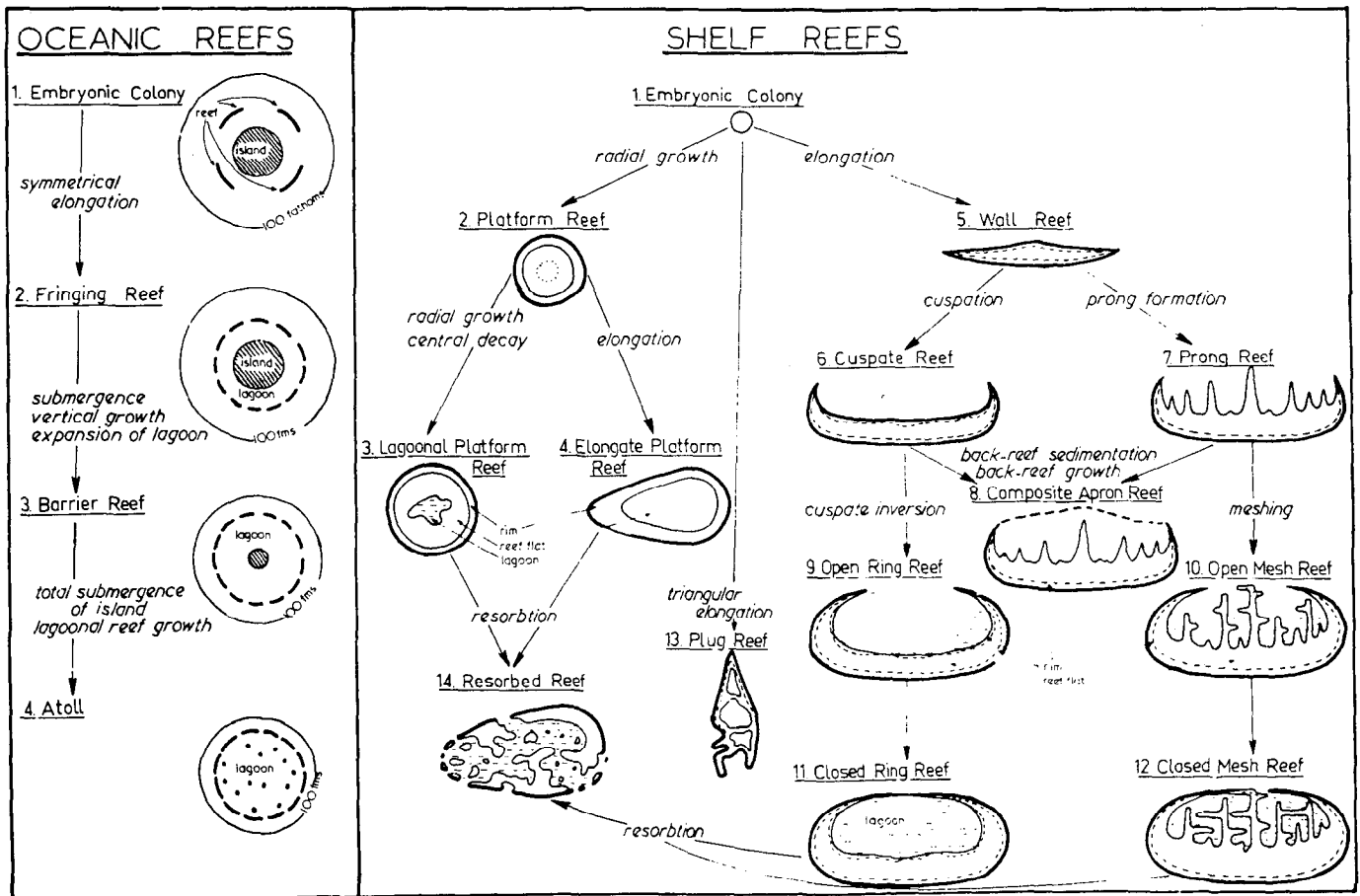


3. METHOD

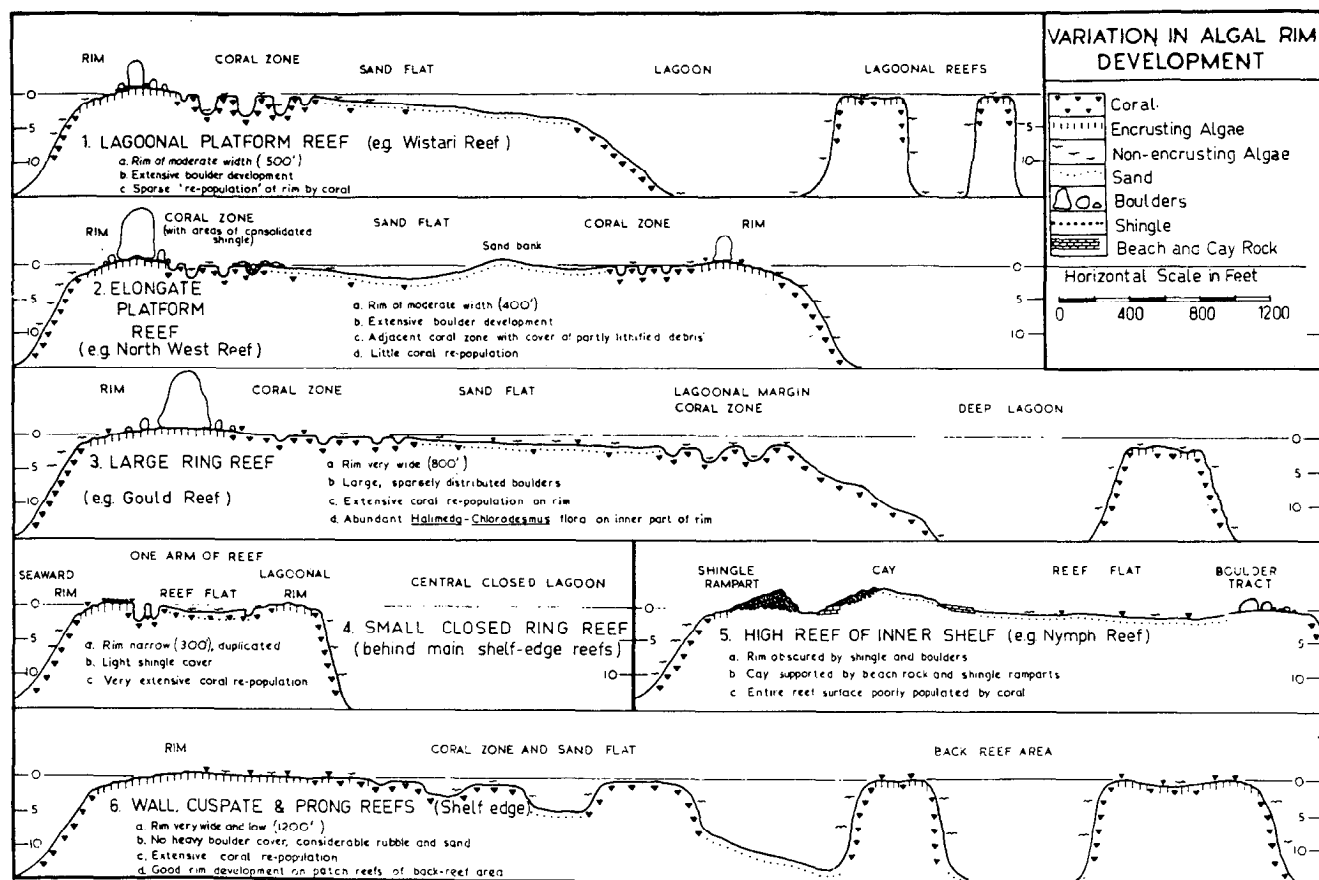
In devising a standard terminology of reef features, whether it be for reefs on the GBR or for all reefs in the world, there are two problems. The first is the range and complexity of reef phenomena. The GBR extends for approximately 1 600 km along the Australian coastline, is located in 215 000 km² of ocean and comprises more than 2 000 individual reefs (Done, 1982). Since these reefs are highly variable, a classification based on reef types for example, would have to consider the numerous variations in orientation, type, structure, morphology, zonation, composition and reef development. Such a classification for the GBR was attempted by Maxwell in 1968 and is reproduced here as Figure 1.

Figure 1. A classification of reefs (reproduced with permission from Maxwell, 1968).



The second problem relates to non-documentation of the similarities and differences which are found within and between reef phenomena on the GBR and other reefs of the world (Hopley, 1982; Longman, 1981; Hill, 1974). A rare example of such documentation, for the GBR only, is given in Maxwell (1968) where the variation in development of an 'algal rim' on different reef types is compared in Figure 2 below.

Figure 2. Variation in the development of the algal rim on different reef types (reproduced with permission from Maxwell, 1968).



'A terminology for reef phenomena' is, in effect, a taxonomy of reef forms. Yet there is insufficient published field data available on the GBR to categorise and assess the degree of applicability of such a taxonomy. So, rather than try to derive terms from 'the imperfect and perhaps biased existing field knowledge on reefs' (Stoddart, 1978a, 1978b), the frequency of reef term usage in the GBR literature was analysed and used to develop the nomenclature presented here.

An appropriateness of choice of coral reef identities for the GBR situation is based on a census among publishing scientists. The technique is a variant of 'content analysis' developed by historians and widely used by social scientists. However, the overall lack of definitions, descriptions, sketches or photographs of the reef features which are specifically labelled by publishing scientists does not allow a detailed examination and comparison of definitions of similar reef phenomena or similar nomenclatures. In fact, a survey of the literature indicates that terms are often used interchangeably, are misleadingly employed, or are not defined.

In a Great Barrier Reef Committee publication for example, the labels 'outer reef flat' or 'coral-algal' or 'living coral subzone' were used interchangeably, as were 'reef rock rim' and 'reef rim' (GBR Committee, 1978). Similarly, a publication by the GBR Committee (1978) describes 'Wilson Island as a mixed shingle/sand cay' and 'Lady Musgrave as a sand and shingle cay'. The terms 'island' and 'cay' are used interchangeably and yet other authors (Flood, 1978; Veron, 1978d) have used 'island' to indicate a continental island and 'cay' to indicate the accumulation of reef sediments (sand cay, shingle cay). The term 'breastwork' is used but not defined in the literature (Stoddart, McLean, Scoffin, Gibbs, 1978), and the difference between the use of the terms 'breastwork', 'ridges', and 'ramparts' is unclear.

This attempt to standardise GBR terminology is heavily based on Kuchler's 1984 PhD. thesis, in which may be found the detailed analysis of the usage trends upon which this nomenclature is based. The analysis is not reproduced here because of space restrictions, the two tables combined representing in excess of 100 pages.

The author recognises that a superior nomenclature would be derived from a priori knowledge and from an assessment of the application of each term to the GBR. The literature to date, however, is insufficient to allow the creation of a taxonomy based on field verification.

Furthermore, knowledge of conditions on the whole GBR is still incomplete. Since the immediate labelling and mapping requirements for satellite, aerial photographic and ground data need to be met, this study produces from circulated GBR literature a list of terms used (Table 1) while the trends in their usage for geomorphological reef zones and features are available in Kuchler, 1984 (Volume 2).

The coral reef terms having the highest frequency of use are taken as being the most generally accepted among scientists. However, these were not always strictly used in the proposed nomenclature. In step one, the term in each entry in Kuchler (1984, Volume 2, Figure 4) with the highest frequency of use was identified. Then, in step two, this term was evaluated for its appropriateness to a semi-hierarchically conceived classification system and its application to the different levels of mapping detail possible for the GBR.

The nomenclature was developed to contribute towards achieving the aim of constructing a classification system for use with remotely sensed data. A term which fulfilled both steps one and two, that is, which had both the highest frequency of use and fulfilled the conditions of appropriateness, was included in the nomenclature. For example, the term 'moat' has the highest frequency of use and is appropriate for different levels of mapping detail. However, in cases where a term had the highest frequency of use (passes step one) but was not appropriate for the classification situation (not suitable in step two), the term with the next highest frequency of use was then identified and tested against step two.

This process continued until an appropriate term was included in the nomenclature. For example, the term 'sand cay' is the most frequently used in the literature but the term 'cay' having the second highest frequency of used was selected for the standard nomenclature (Table 1) because 'cay' is a general term which may be used also to describe shingle cays and vegetated cays. The term 'sand cay' is too specific.

Table 1. Terms used in the literature to describe geomorphological reef cover and zonation on the Great Barrier Reef.

1.0 drop off	leeward flat	10.0 sand flat
<u>REEF FRONT</u>	inshore reef flat	blanket sands
leeward margin	sanded reef flat	<u>SAND ZONE</u>
windward margin	reef flat corals	<u>SAND PATCHES</u>
<u>REEF SLOPE</u>	coral reef flat	sand blanket
reef wall	coral flat	sand sheet
outer rampart face	sandy reef flat	
leeward/windward face	live coral reef flat	11.0 <u>BASSETT EDGES</u>
outer face		foreset beds
reef front slope	4.0 <u>LAGOON</u>	<u>BREASTWORK</u>
fore reef slopes	5.0 mangrove shingle	12.0 <u>SWALES</u>
hard line reef front	rampart-platform	
seaward platform	island	13.0 <u>SAND CHUTE</u>
windward platform	mangrove-shingle	<u>CHUTE</u>
windward front	island	
lee side detrital	continental islands	14.0 <u>ROCK SLOPE</u>
slope	compound islands	scree slope
leeward reef slope	high islands	<u>REEF ROCK SLOPE</u>
windward reef slope	continental high	
outer slope	island	15.0 <u>SPUR AND GROOVE</u>
windward slope	mangrove-shingle cay	groove and buttress
outer reef slope	mangrove islets	saw-tooth area
marginal slope	coral cay	buttress and channel
	<u>SAND CAY</u>	buttresses and valley
2.0 reef edge	<u>CAY</u>	surge channels
reef crest	un/vegetated cay	reef front grooves
<u>REEF RIM</u>	leeward sand cay	spurs/ridges
reef rock rim	intertidal sand body	outer reef buttresses
reef rock margin	<u>ISLAND</u>	buttress zone
windward edge	coral sand cay	reef buttress zone
leeward edge	sand-shingle cay	prong and buttress
reef/the perimeter	mixed shingle-sand	formation in back
hard line margin	cay	reef zone
outer reef crest	rubble cay	
open water reef crest	shingle island	16.0 submarine moat
platform summit		<u>MOAT</u>
leeward margin	6.0 back-reef apron	submarine trough
reef margin	foul ground	trough
reef margin	<u>BACK REEF (ZONE)</u>	marginal surface
rim margin	patch reefs of	<u>CHANNEL</u>
rubble crest	back reef area	subsurface channel
hard line perimeter	reef back	reef flat moat
crest	back-reef banks	trench
rim	back-reef margin	
frontal rim	back-reef slope	17.0 <u>GULCHES</u>
3.0 <u>OUTER REEF FLAT</u>	7.0 back channels	18.0 <u>MICROATOLLS</u>
shallow reef flat	<u>DELTAIC PATTERN</u>	
dying reef flat	dissected reefs	19.0 <u>SEDIMENT WEDGE</u>
dead coral reef flat	deltaic system	sand wedge
rubble reef flat	deltaic reefs	
windward reef flat	8.0 <u>OFF-REEF FLOOR</u>	20.0 trickle zone
leeward reef flat	leeward off-reef	<u>ALIGNED CORAL ZONE</u>
reef platform	floor	radial zone
middle reef flat		
algal flat	9.0 <u>BLUE HOLES</u>	
<u>REEF TOP</u>		
planar reef top		
<u>INNER REEF FLAT</u>		
sand subzone		
<u>REEF FLAT</u>		
the flat		

Table 1. Continued.

21.0 living coral subzone coral-algal subzone zone of living coral coral-sand subzone <u>OUTER LIVING CORAL ZONE</u> live coral zone non-aligned coral zone <u>DEAD CORAL ZONE</u> <u>CORAL POOLS</u>	28.0 coral beach <u>BEACH</u> cay beach sand beach	34.0 <u>REEF FLANKS</u> flanks leeward flanks
22.0 sea-grass reef flat <u>SEAGRASS BEDS</u> Thalassia grass marine grass seagrasses	29.0 <u>SAND SPIT</u> littoral spit <u>SPIT</u>	35.0 sand slope algal slope
23.0 <u>SHALLOW LAGOON</u> <u>MEDIUM LAGOON</u>	30.0 <u>BEACH ROCK</u> cay rock <u>REEF ROCK</u> <u>BOULDER-ROCK</u> <u>RAMPART-ROCK</u> <u>PHOSPHATE ROCK</u> boulder-tract-rock island-rock conglomerate rock rampart/rock platform rock slabs	36.0 <u>TERRACES</u> algal terraces submarine terrace
24.0 blue lagoon <u>DEEP LAGOON</u> second lagoon third lagoon	31.0 <u>CORAL/SHINGLE RIDGE</u> rubble banks boulder bank reef bank boulder zone <u>PLATFORM/PROMENADE</u> <u>CORAL/SHINGLE RAMPART</u> mangrove rampart <u>RAMPARTS</u> rampart conglomerate rampart system beach ridge ridges rim deposits coral shingle mounds submarine ridges	37.0 <u>REEFAL SHOALS</u> <u>SHOALS</u>
25.0 back-reef apron in lagoon lagoonal sediments sandy lagoon <u>LAGOON FLOOR</u> lagoonal apron reef rim apron ring-reef apron open lagoon leeward <u>LAGOON WALLS</u> lagoonal margin	32.0 coral rubble shingle rubble boulder rubble coral gravel rubble zone <u>CORAL RUBBLE ZONE</u>	38.0 niggerheads reef blocks negro heads megablock <u>CORAL HEADS</u> bommies/bombies boulders blocks coral boulders
26.0 lagoonal coral heads lagoon corals <u>PATCH REEFS</u> coral colonies lagoonal reefs isolated/DISPERSED lagoonal reefs <u>RETICULATE lagoonal</u> reefs isolated/REMNANT lagoonal reefs <u>LAGOON CORAL</u> <u>PATCHES</u> lagoonal patch reef reef studded lagoon deep mesh - reef lagoon	33.0 mangrove scrub mangrove park <u>MANGROVES</u> <u>MANGROVE SWAMP</u> mangrove vegetation Rhizophora swamp	39.0 <u>ALGAL ridge</u> Lithothammon ridge algal pavement algal ramp algal zone algal platform
27.0 woodland vegetation <u>VEGETATION</u> herbaceous vegetation		40.0 Lithothammon rim <u>ALGAL RIM</u> coralgal rim corraline algal rim corraline algal zone
		41.0 depressed central strip

Entries in UNDERLINED CAPITALS are those most frequently used.
 Entries in **BOLDED CAPITALS** are those chosen for the nomenclature.
 Entries in UNDERLINED BOLDED CAPITALS are both the most frequently used, and chosen for the nomenclature.