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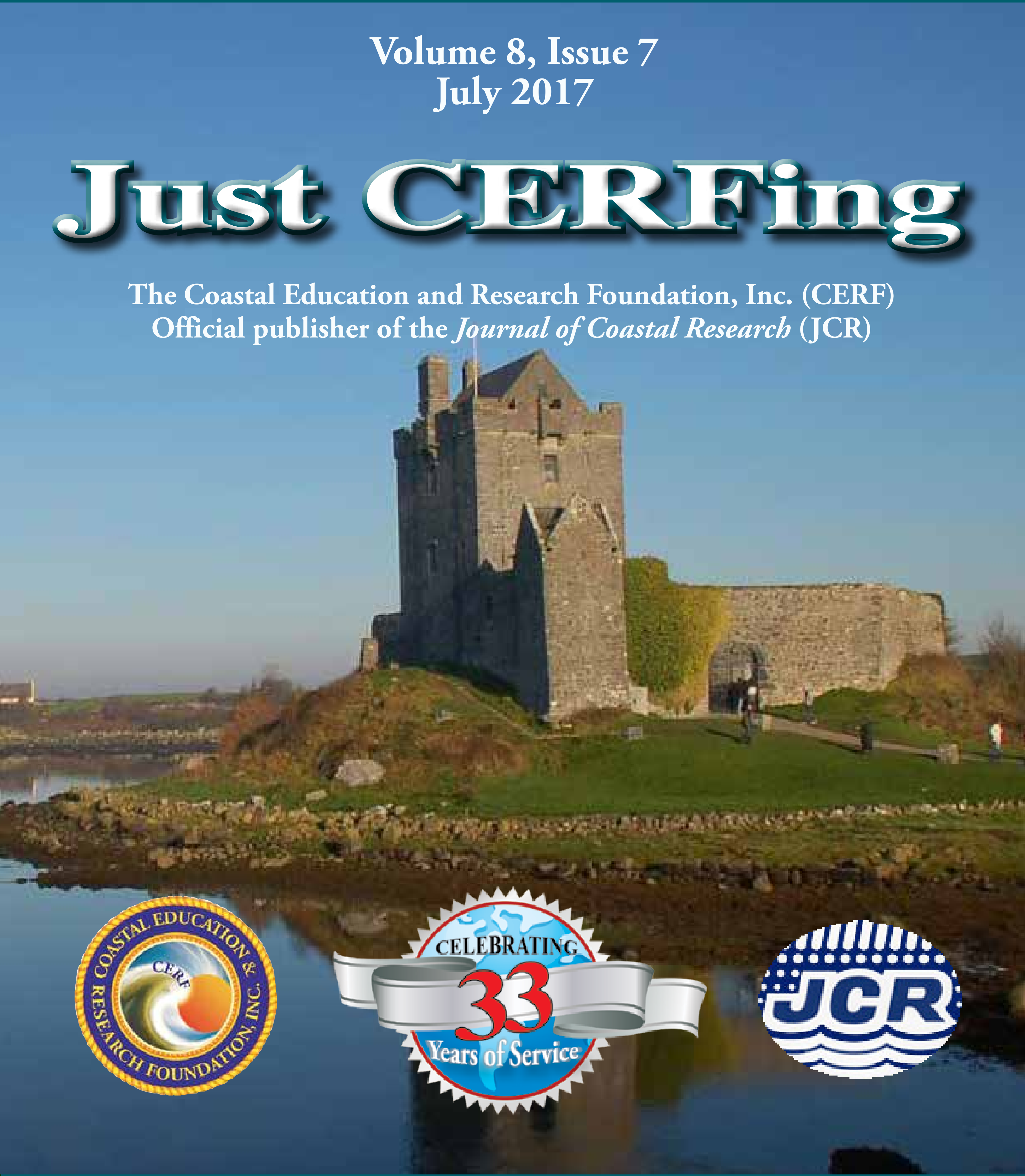

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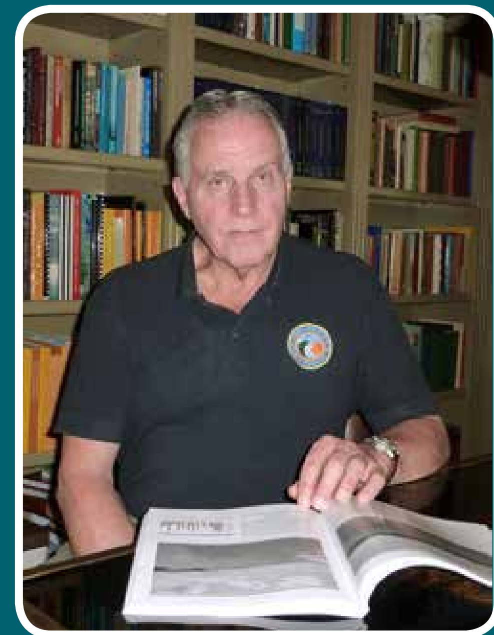

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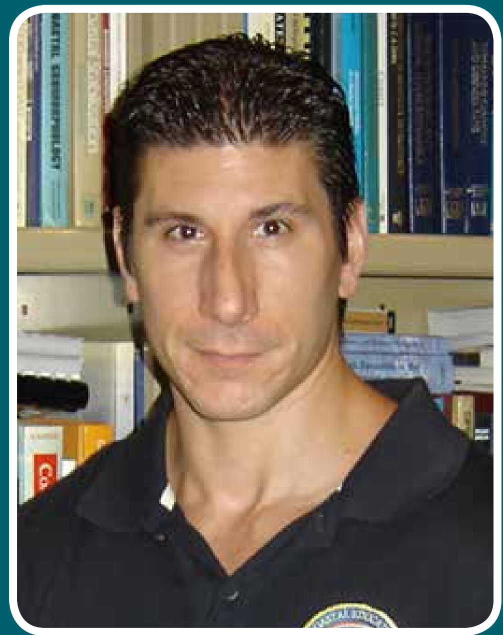

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Coastal Education and Research Foundation *[CERF]* is pleased to announce our newly appointed Regional Vice Presidents (RVP), who throughout the international scientific community continue to provide outstanding representation of our coastal research society. Please join us in honoring the following individuals for their tremendous service and support of CERF and the JCR.

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Marcel J.F. Stive, Ph.D.

## Oceania

Charles Lemckert, Ph.D.
Anja Scheffers, D.Sc.
Vic Semeniuk, Ph.D.
Andrew D. Short, Ph.D.


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## CERF RVP (Southeast Asia)

### Nobuo Mimura, D.Eng.

Nobuo Mimura, D.Eng., is currently serving as the President of Ibaraki University. His academic areas of expertise are global environmental engineering, coastal engineering, and adaptation policy to climate change. Dr. Mimura has also been a member of the advisory committees for Ministry of Foreign Affairs, Ministry of Infrastructure, Land and Transportation, Ministry of the Environment and Ministry of Education, Culture, Sports, and Science and Technology.

## CERF RVP (North America)

### James R. Houston, Ph.D.

Jim Houston, Ph.D., is Director Emeritus of the U.S. Army Engineer Research and Development Center (ERDC), which includes all the research and development laboratories of the Corps of Engineers. He managed one of the most diverse research organizations in the world – seven laboratories at four geographical sites, with over 2,000 employees and an annual program budget of $1.3 billion. Dr. Houston has published over 130 technical reports and papers and has received several honors and awards including three Presidential Rank Awards and the National Beach Advocacy Award.

### Vic Klemas, Ph.D.

Vic Klemas, Ph.D., is Professor Emeritus in the University of Delaware's College of Earth, Ocean, and Environment. He directed UD's Applied Ocean Science Program from 1981-98, and he has co-directed UD's Center for Remote Sensing for more than 30 years. Dr. Klemas has served on six scientific committees of the National Research Council and received a number of awards, including, in November 2010, the Science Prize of the Republic of Lithuania. The honor recognized his lifetime achievements in applying remote sensing and other advanced techniques to study coastal ecosystems.

### Orrin H. Pilkey, Jr., Ph.D.

Orrin H. Pilkey, Ph.D., is a James B. Duke Professor Emeritus of Geology within the Division of Earth and Ocean Sciences and Director Emeritus of the Program for the Study of Developed Shorelines (PSDS) in the Nicholas School of the Environment and Earth Sciences at Duke University. Since 1965, Dr. Pilkey has been at Duke University with one-year breaks with the Department of Marine Science at the University of Puerto Rico, Mayaquez, and with the U.S. Geological Survey in Woods Hole, Massachusetts. His research career started with the study of shoreline/continental shelf sedimentation, progressed to the deep sea with emphasis on abyssal plain sediments, and back to the nearshore with emphasis on coastal management. Dr. Pilkey has published more than 250 technical publications and has authored, coauthored, or edited 39 books.

## CERF RVP (South America)

### Vanda Claudino-Sales, Ph.D.

Vanda Claudino-Sales holds a Ph.D. in Geography from the Sorbonne University and a Post-Doctorate in Coastal Geomorphology from the University of South Florida; coming back later to those universities as visiting professor. Now, she is a professor in the Department of Geography at the Federal University of Ceará and part of the Master in Geography program at the State University Valley of Acarau, in Brazil. Her research focuses on areas of geoscience, acting mainly in coastal geomorphology, environmental geomorphology and geoconservation. With her graduating students and her research team, she is currently studying the coastal dynamics and the impacts of development in tropical coasts. She also has an interest in coastal management and participates in environmental social actions in Brazil.

### Omar Defeo, D.Sc.

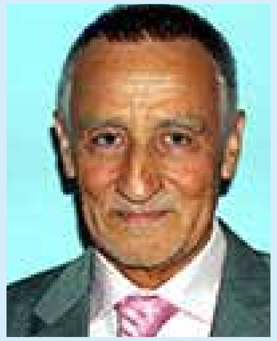
Omar Defeo, D.Sc., is a professor in the Marine Science Unit at the Universidad de la República in Uruguay. He is also among a select group of ecologists worldwide working on sandy beach ecosystems and how they are threatened by climate change. For the past 15 years, Prof. Defeo has also been involved in artisanal shellfisheries, ecology, and conservation of coastal marine invertebrate biodiversity research in Latin America, primarily in Mexico and Chile.

## CERF RVP (Eastern Europe)

### Niki Evelpidou, Ph.D.

Dr. Dr. M.Sc. Niki Evelpidou is an Associate Professor at the Faculty of Geology and Geoenvironment, National and Kapodistrian University of Athens. She is a distinguished Doctor in both the Faculty of Geology and Geoenvironment of the University of Athens and the Faculty of Geoarchaeology of the University of Franche Compte (France). Dr. Dr. Evelpidou is actively involved in the research fields of geomorphology, coastal geomorphology, sea level changes, palaeogeography, geology, spatial technologies, study and modelling of natural hazards, while emphasizing on the use of new technologies and innovation. She counts more than 180 scientific publications and 17 books and textbooks, while she has given many lectures in Greece and abroad.

### Kazimierz K. Furmańczyk, D.Sc.



Kaz Furmańczyk, D.Sc., is currently Full Professor at the University of Szczecin and the Head of the Remote Sensing and Marine Cartography Unit at the Institute of Marine and Coastal Sciences. Author and co-author of over 100 scientific publications including books (2) and chapters, journal articles, abstracts, and conference papers. Contributions are mainly in the disciplines of remote sensing, coastal sciences, hydrology, and oceanography. In May 2011, he served as the local Chair and Co-organizer of the 11th International Coastal Symposium (ICS) that took place in Szczecin, Poland.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## CERF RVP (Western Europe)

### Luciana S. Esteves, Ph.D.

Luciana Esteves, Ph.D., is a principal academic in the Faculty of Science and Technology and Global Engagement Leader for the Department of Life and Environmental Sciences, Bournemouth University, U.K. The scope of her research includes monitoring and quantifying coastal changes driven by natural and human-induced process and the implications to coastal management. More recently, her work on managed realignment schemes in Europe and practical applications of ecosystem based management in northeast Brazil have led to capacity building workshops for government practitioners and researchers in South Africa and Latin America. She was involved in the organising committee of the International Coastal Symposium 2013 and will co-chair the ICS in 2022. Dr. Esteves actively promotes gender equity in science (she is a founding member of the international network Women in Coastal Geosciences and Engineering) and undergraduate students engagement in research (she chaired the British Conference of Undergraduate Research in 2017 and coordinates the Showcasing Undergraduate Research Excellence conferences at Bournemouth University).

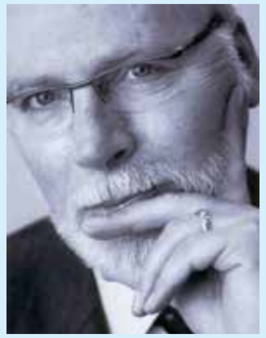
### Carlos Pereira da Silva, Ph.D.

Carlos Pereira da Silva, Ph.D., is the Director of e-GEO within the Research Centre for Geography and Regional Planning at the Universidade Nova de Lisboa, Portugal. Dr. Pereira da Silva's research interests are mainly focused on coastal zone management, with specific emphasis in beach management, public participation studies, and carrying capacity. A long time supporter of CERF and the JCR, in April 2009, he served as the local Chair and Co-organizer of the 10th International Coastal Symposium (ICS) that took place in Lisbon, Portugal.

### Michael Phillips, Ph.D.

Professor Mike R. Phillips (BSc, PGCE, MSc, PhD, MIEnvSc, FRGS) serves as Pro Vice-Chancellor of Research, Innovation, Enterprise, and Commercialization at the University of Wales Trinity Saint David (Swansea Metropolian). Professor Phillips research expertise includes coastal processes, morphological change and adaptation to climate change and sea-level rise. Consultancy includes beach replenishment issues and developing techniques to monitor underwater sediment movement to inform beach management. He is widely published and recently organized a session on Coastal Tourism and Climate Change at UNESCO Headquarters in Paris as part of his role as a member of the Climate Change Working Group of the UNEP Global Forum on Oceans, Coasts, and Islands.

### Marcel J.F. Stive, Ph.D.



Until 2010, Marcel Stive, Ph.D., was Scientific Director of the Water Research Centre Delft, which is now embedded in the Delft Research Initiative Environment. He currently holds the positions of: Chair of Coastal Engineering in the Section of Hydraulic Engineering and Department Head of Hydraulic Engineering at Delft University of Technology. Dr. Stive was recently appointed Knight in the Order of the Dutch Lion in theatre the Rijswijkse Schouwburg in Rijswijk. He was presented with this award for his outstanding record as a top researcher, much consulted expert, distinguished engineer, and inspiring teacher.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## CERF RVP (Oceania)

### Charles Lemckert, Ph.D.

Charles Lemckert, Ph.D., is the Head of Discipline of Civil Engineering at Griffith University's School of Engineering. He has active research interests in the fields of physical limnology, coastal systems, environmental monitoring techniques, environmental fluid dynamics, coastal zone management, and engineering education. Along with his postgraduate students and research partners, Dr. Lemckert is undertaking research studies on water treatment pond design (for recycling purposes), the dynamics of drinking water reservoirs, the study of whale migration in southeast Queensland waters, and ocean mixing dynamics. In 2007, he served as the local Chair and Co-organizer of the 9th International Coastal Symposium (ICS) along the Gold Coast of Australia.

### Anja Scheffers, D.Sc.

Anja Scheffers, D.Sc., is currently Full Professor at Southern Cross University in Lismore, NSW, Australia. Her main area of study is coastal evolution, including sea-level change and marine physical natural hazards. Her research specializes in using sedimentary signatures to decipher long-term records of environmental change from the natural environment. She is particularly interested in processes that shape and modify coastal landscapes over a variety of length and time scales and the coupling and feedback between such processes, their rates, and their relative roles, especially in the contexts of variation in climatic and tectonic influences and in light of changes due to human impact. Dr. Scheffers is also the recipient of the ARC Future Fellowship Award for "Unraveling Western Australia's Stormy Past - A Precisely-Dated Sediment Record of Cyclones over the past 7000 years" and has been awarded multiple research grants from such prestigious entities as the German Research Council, the German Research Foundation, and the Australian Research Council.

### Vic Semeniuk, Ph.D.

Vic Semeniuk, Ph.D., is a natural history research scientist, specialising in coastal, estuarine and wetland environments, and mangrove and tidal flat environments. He has 45 years experience in scientific research in Australia, Europe, Canada, the USA, Ireland, the United Kingdom, and South Africa. Dr. Semeniuk is currently the Director of the Research & Development Firm, the V & C Semeniuk Research Group, and has over 130 publications in refereed scientific journals. He also has a proactive interest in conservation and coastal management, and has published multiple scientific works directly and indirectly leading to this objective.

### Andrew D. Short, Ph.D.

Andy Short, Ph.D., served as the Director of the Coastal Studies Unit at The University of Sydney and has been the National Coordinator of the Austra-lian Beach Safety and Management Program in cooperation with Surf Life Saving Australia. Dr. Short is mainly interested in the processes and mor-phology of coastal systems. His present research focuses on the beach and barrier systems of Australia, as it relates to the morphodynamics of repre-sentative systems in variable wave and tide environments, and in the nature, hazards, and usage of all Australia beach systems.

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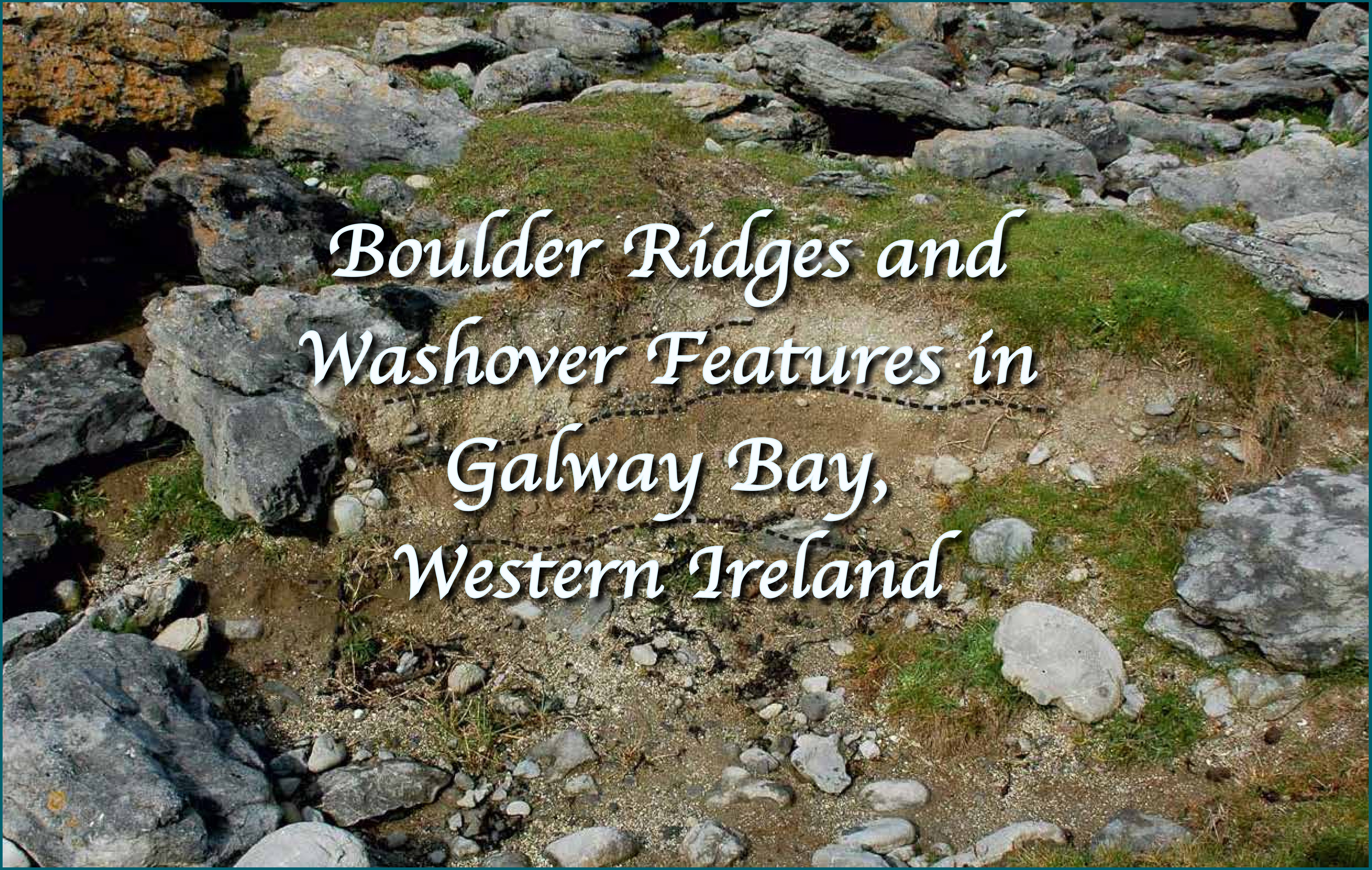
Boulder Ridges and
Washover Features in
Galway Bay,
Western Ireland

# Boulder Ridges and Washover Features in Galway Bay, Western Ireland

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## ABSTRACT

Boulder deposits of the Aran Islands in the Galway region (western Ireland) have been under investigation for more than 10 years, whereas marine and littoral deposits inside Galway Bay have only been mentioned cursorily. The aim of this study is to investigate all coastal deposits along the most exposed bay coasts from the opening of South Sound to Black Head 25 km inside Galway Bay. Long ridges with imbricated large boulders exist near the surf belt, whereas boulder deposits in clifftop positions are mostly chaotic. The size of individual boulders is similar to those on the exposed island sites of the Aran archipelago. Landward of boulder ridges, stratified fine sediments occur that point to quiet sedimentary conditions. Two more forms and deposits are mapped that are rarely mentioned for western Europe: boulder ridges with crossway secondary ridges and tonguelike washover deposits of medium boulders, both from extraordinary flow events. Dating of all units resulted in ages back to the first half of the Holocene and mid-Holocene times. During the older periods, sea level in the area was several meters lower than today and the coastline was farther west. Dislocation of very large boulders some thousands of years ago was higher and farther inland than by the strongest storms of recent times. This requires interpretation with respect to formation processes and their results in exposed and more sheltered littoral environments.

**ADDITIONAL INDEX WORDS:** *Coastal sediments, boulder movement, storms, tsunamis, sedimentology, extreme events, Holocene.*

## INTRODUCTION

Holocene coastal boulder deposits on the central west coast of Ireland (Galway Bay and Aran Islands) represent the most spectacular evidence of those features by marine forces yet described worldwide in a natural setting. In several respects, the Galway and Aran boulder deposits surpass all others known: extension for kilometers, elevation above sea level (up to 30 m), distribution to inland (up to 250 m), and the mass of single boulders exceeding 50 or even 70 tons with longest axes of more than 10 m (*e.g.*, Erdmann *et al.*, 2015). These are all larger, higher, or farther inland than similar deposits in SW Iceland (Etienne and Paris, 2010), Banneg Island (Brittany, France, according to Fichaut and Suanez, 2008, 2011; and Suanez, Fichaut, and Magne, 2009), or other exposed shore-lines of the world. Boulder ridges and boulder clusters on the Shetland Islands, as described by Hall, Hansom, and Williams (2010), and Hall *et al.* (2006), also have less elevation and landward extension and smaller boulder sizes. Larger boulders or blocks (greater than 100 tons) are only known as single features (*e.g.*, Engel *et al.*, 2014, from the Philippines; Frohlich *et al.*, 2009, from Tonga; or Playford, 2014, from Western Australia).

The natural disposition of boulder movement by marine forces along the Aran Islands is close to an optimum; plunging cliffs are exposed to the fetch of the northern Atlantic Ocean combined with stratified limestone fractioned by joint patterns. This enables marine forces to break off fragments of platy form. However, even the largest fragments represent the maximum transport power of marine forces only if they meet the maximum size classes of individual

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joint-bound or loose boulders in a relief, which allows maximum inundation and wave run-up values. This is the case in the Galway-Aran region. In most natural settings, boulder size is limited, and one will never know which sizes of boulders would have been moved if present during the strongest impacts.

The 60-km W-E axis of Galway Bay separates a granite landscape in the north from an undulating Carboniferous limestone terrain in the southeast. The overall geomorphology derives from multiple glaciations that extended over the entire bay and the chain of the Aran Islands, disappearing from the area between 17,000 and 16,000 BP (Clark *et al.*, 2012; Diefendorf *et al.*, 2006; Van Asch *et al.*, 2012). The mapping of the sea floor by Sacchetti *et al.* (2011) exhibits end moraines of the last glaciation up to 100 km west of the Aran Islands. Meltwater deepened the sounds framing the Aran Islands (Figure 1) and 50 to 60 m of water is present today. Indications for a total ice cover, at least during the Last Glacial Maximum (LGM), are erratic boulders from Connemara and Galway granite that are present on all Aran Islands but rare between Doolin and Black Head.

Within Galway Bay, cliffs with a maximum of 30 m often exhibit stepped structural platforms down to the foreshore. Maximum cliff heights in the wider area (approximately 70 m) occur on the SW coast of Inishmore Island. The intensity of cliff retreat in the area is under debate: Cox *et al.* (2012), Williams (2004), and Williams and Hall (2004) argue for rates of several decimeters per year (0.2–0.4 m/y, and at some places up to 0.8 m/y). Estimates are smaller and based on well-preserved glacial rock profiles on the east coast of Inishmore and the west coast of Inishmaan. These profiles allow only a maximum of 100-m cliff retreat, because the Holocene high sea level indicates a rate of marine erosion of a few centimeters per year on average (see also Carbone *et al.*, 2013; Devoy, 2008; Hall, Hansom, and Jarvis, 2008; McKenna, Carter, and Bartlett, 2009; Rosser *et al.*, 2005, 2010). This rate is less than that from data from the chalk cliffs of the English Channel (Recorbet *et al.*, 2010) and approximately half rates found in resistant rock by Earlie *et al.* (2015, 0.1 m/y), Lim *et al.* (2010, 2011), and Young *et al.* (2011, approximately 8 cm/y). More arguments for a slow cliff retreat come from karst features (karren or meander karren and rainwater pools) on cliff platforms. The topography indicates that Gregory and Foul Sounds (Figure 1) existed before and during the LGM. Scheffers *et al.* (2009) argued for a small rate of coastal retreat because of the existence of Neolithic to Iron Age middens, Iron Age promontory forts, Viking boat shelters, and medieval castles still close to the modern shoreline or on sheer cliffs. Scheffers *et al.* (2010) added arguments from the development of rock pool belts along the mean high water (MHW) level or from old photographs from distinctive morphological features such as the Wormhole (published by Fehman, 1999, p. 34).

When LGM ice receded from the Galway region from 17,000 to 16,000 BP, Galway Bay was a wide basin 30 to 60 m above sea level, fringed on the west by three main and three minor elongated elevations in the form of cuestas (now the Aran, Brannock, and Rock Islands) (Clark *et al.*, 2012; Diefendorf *et al.*, 2006; Van Asch *et al.*, 2012). Meltwater streams drained the basin through two wide openings in the north and south (North Sound and South Sound; Figure 1) and two smaller channels between Inishmore and Inishmaan and between Inishmaan and Inisheer.

Sea level in the Holocene was never higher than today on the central west coast of Ireland (Bradley *et al.*, 2011; Brooks *et al.*, 2007; Carter, Devoy, and Shaw, 1989; Fleming *et al.*, 1998; Holmes *et al.*, 2007; Lambeck *et al.*, 2014; O'Carra *et al.*, 2014; Orford, Murdy, and Freel, 2006; Peltier *et al.*, 2002; Schettler *et al.*, 2006; Shaw and Carter, 1994; Shennan and Horton, 2002; Shennan *et al.*, 2002; Shennan, Milne, and Bradley, 2012). In addition to geomorphological and sedimentological arguments and those from the modeling of glacioisostatic rebound, the lack or rareness of Mesolithic (7000–4000 BC) and Neolithic or Bronze Age (4000–600 BC) archeological remains in the immediate coastal environment also point to ongoing drowning (Driscoll, 2012; Gosling, 1993). Williams and Doyle (2014) published data for rooted trees (oak from 7200 and 6200 BP and pine from 7400 and 5750 BP) in the lower modern tidal realm in northern Galway Bay exposed by recent storms (compare with Figure 1) as evidence for a sea level 5 m (61 m) below the present level during their growth periods. Because these tree stumps are covered by freshwater peat up to 2 m, it is assumed that inner Galway Bay was a swampy environment with a coastline farther toward the bay opening in the west. Holmes *et al.* (2007) identified a similar sea-level curve from the karst lake An Loch Mór on Inisheer Island of the Arans, and dating of inactive dunes at


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Fanore and the time of drowning of their source area resulted in similar data.

The westward opening of North Sound and the southward opening of South Sound allow waves and swell into Galway Bay, which is large enough to develop its own wave regimes during strong storms. Tides are another important factor, ranging from 1.8 m during neap tide to 4.2 m during spring tides at Kilronan (Inishmore) and up to 5.2 m near Galway city (according to Chart 3339, British Admiralty, 2005). Storm surges are a threat to the inner bay shorelines because of the funnel shape of the bay.

Stepped cliff profiles with platforms adapted to strata are characteristic between Doolin and Black Head. Marine indentations are controlled by small valleys or synclines in the rock structure. At Poulcraveen and Cancapple (for locations, see Figure 2), active cobble beaches occur, and sandy beaches occur in Fanore Bay. Dune fields (at Fanore and Doolin) are inactive and covered by dense vegetation. The most significant signature along the coastal section from Doolin to Black Head is boulder deposits up to many meters above the high water mark that consist of single large boulders of many tons in mass (Figures 3 and 4), boulder clusters, or boulder ridges (Figures 4, 5, 11, and 12), as described and documented in detail by Erdmann *et al.* (2015). Their maximum elevation along the SE section of Galway Bay is 23 m above MHW, their width generally is less than 100 m, and their maximum thickness is 5 to 6 m. In contrast to the open SW coasts of the Aran Islands, the foreshore along the section from Doolin to Black Head is mostly shallow; the 20-m isobath is 400 to 700 m from the cliffs. Rockfalls occur along more or less N-S trending joints opened by limestone dissolution and the constant hammering of high storm waves (Earlie *et al.*, 2015). Talus slopes with very large angular blocks may protect the foot section of cliffs. Over many decades of storm impact, these blocks have been tumbled and rounded and their mass has shrunk. The final stage is a near-total reworking of rockfall products; cliffs may plunge again into deep water, which intensifies wave attack and may lead to the next rockfall. Recession of (vertical) cliffs is an episodic process, and the time frame for collapse and reworking of talus debris depends on exposure to storm waves and particularly on foreshore bathymetry, and it may well happen with temporal steps of centuries.

Wave height observations for the area are found in Aqua-Fact International (2002), Draper (1972, 1991), and Met Éireann (2007). Between January 4 and 6, 2014, offshore waves were on the order of 30 m and those of approximately 21 m were visible from the coast. Six winter storms in 2013–14, all of hurricane categories 3 and 4, were the strongest during at least the last 60 years in western Ireland. The town center of Galway at Spanish Arch was flooded more than 1 m deep, and the Muirios graveyard's protection wall was knocked over by strong waves, which resulted in human remains being uncovered near the village of Baile na hAbhann. The storm history, with emphasis on exceptional events, is discussed in Brayne (2003); Burt (2006); Hickey (2001); Lamb and Frydendal (1991); MacClenahan *et al.* (2001); O'Brian, Dudley, and Dias (2013); and Shields and Fitzgerald (1989), as well as in Erdmann *et al.* (2015) for the winter season of 2013–14.

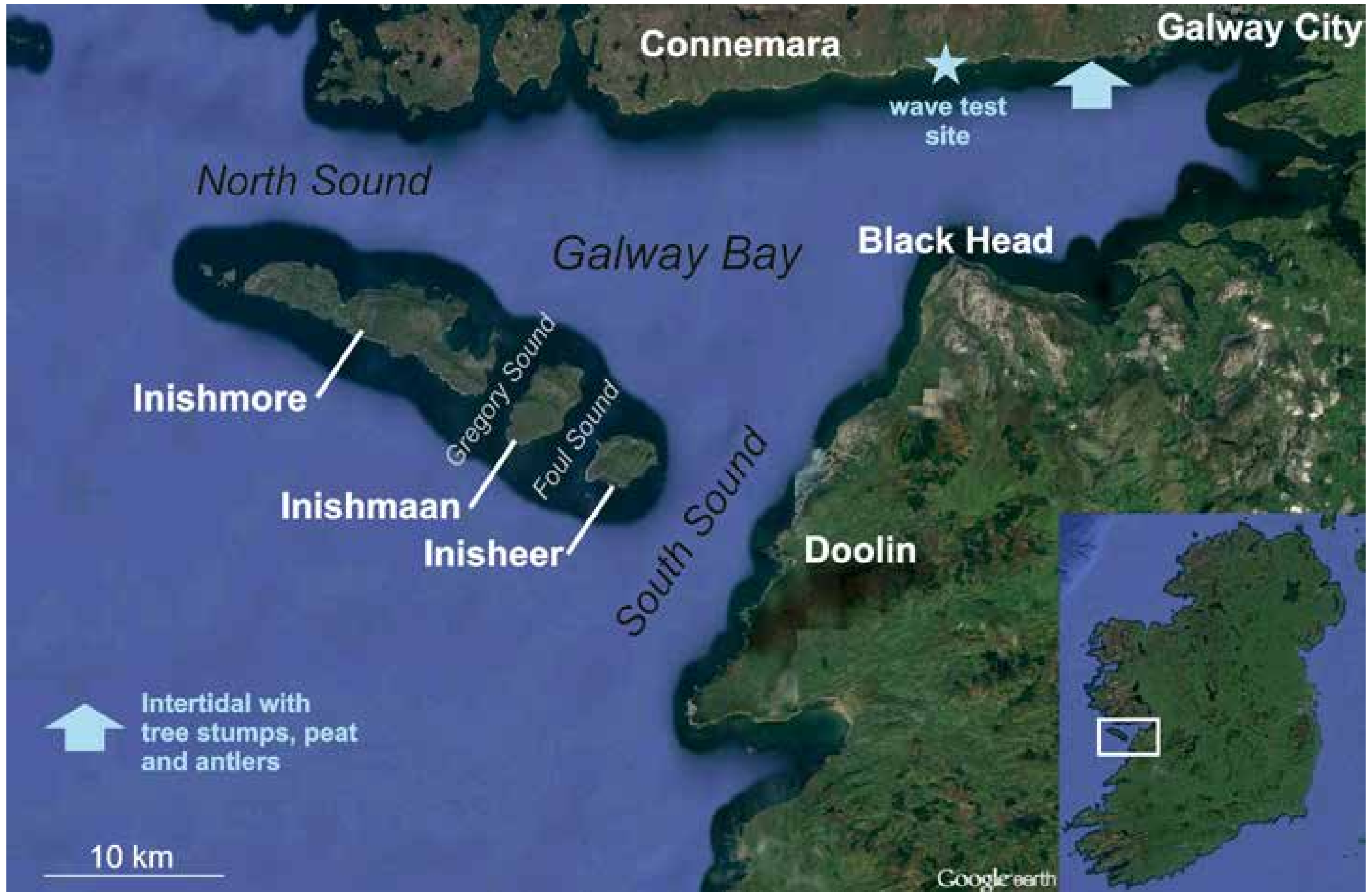


**Figure 1. Galway Bay on the central west coast of Ireland. Field studies for this paper have been concentrated on the section from Black Head to Doolin (satellite image: Google Earth). At the Spiddal wave test site (23-m water depth), the maximum wave height during a 5-year period was approximately 3.5 m.**


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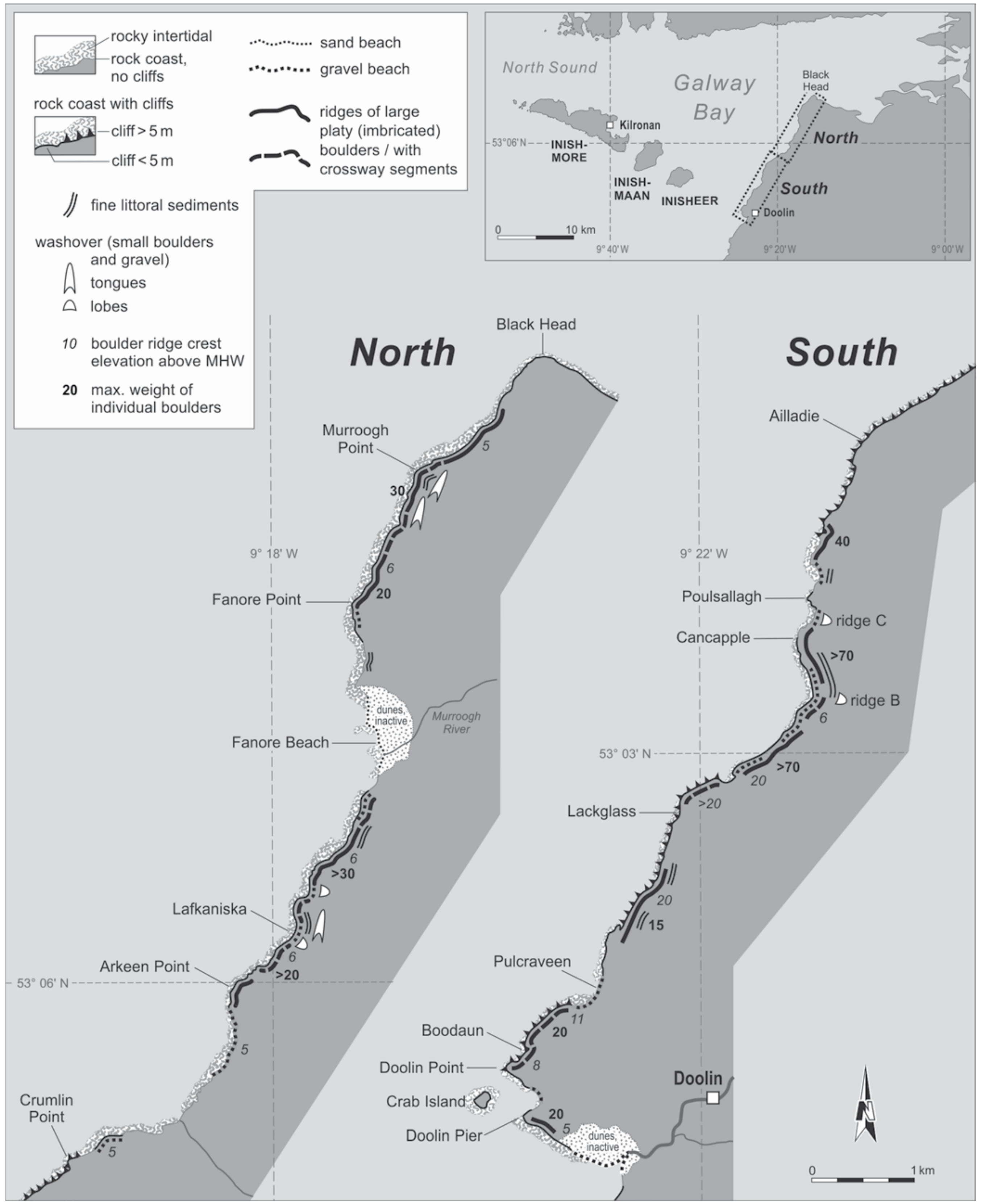


Figure 2. Mapping of the main geomorphological and sedimentological features in the more than 20-km-long study area between Black Head and Doolin, SE coast of Galway Bay, with locations mentioned in the text (cartography: Gudrun Reichert).

Figure 3. Exceptionally large boulder in clifftop position inside Galway Bay near Lackglass 16 to 17 m above MHW, dislocated from its base layer upward. The longest axis is 6.5 m, the width is 4.1 m, the thickness is 3.4 m, the volume is more than 30 m², and the mass is more than 70 tons (people shown for scale).


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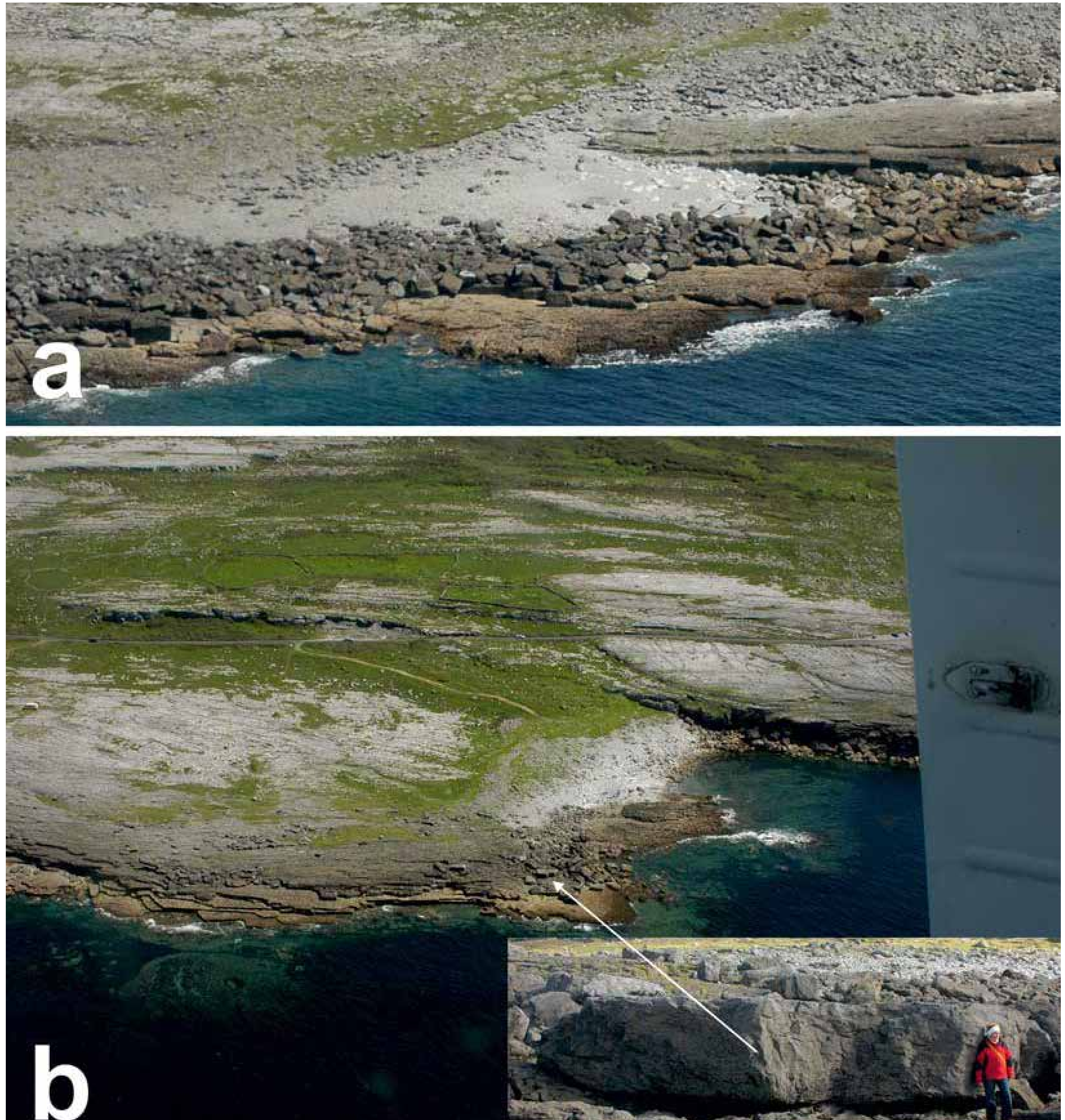


**Figure 4. (a) Boulder ridge with platy fragments (2 to 20 tons) between Poulsallagh and Cancapple, separated from the intertidal zone by a belt of base rock. (b) Large boulder (<50 tons) at Poulsallagh, lifted from structural steps (seen from the west or the sea).**


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**Figure 5. Clifftop boulder ridge approximately 1.5 km south of Lackglass and 15 to 18 m above MHW, spanning 178 m N-S and up to 58 m from the cliff edge (seen September 2015). Fragments were activated during the winter storms of 2013–14; fresh outbreaks from cliff steps are absent.**


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**Figure 6. Fresh angular boulders on a seaward clifftop ridge (most of them taken from the ridge itself) in a chaotic setting.**


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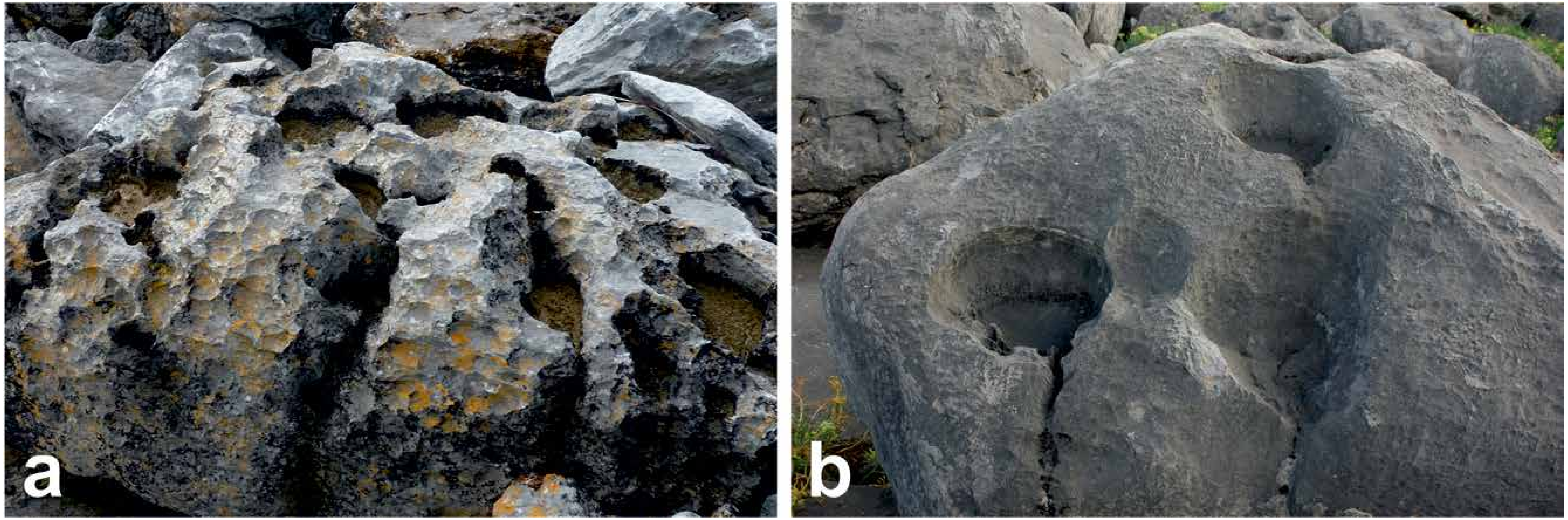


**Figure 7. Biogenic flat-bottomed rock pools from the supratidal zone. Dislocation usually results in inclination, which leads to one point of overflow if filled with rainwater and karrenlike features if overflow rills form. Because freshwater dissolution is a slow process (roughly 0.01 m/y to a maximum of 0.1 m/y, according to the height of karst tables under glacial erratics nearby; compare with Godard *et al.*, 2015), boulder deposition without significant later movement points to several hundred to more than 2000 years of formation.**


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**Figure 8. Significant dissolution forms on top of a 10-ton boulder from Lafkaniska, giving a tentative minimum age of deposition of more than 500 years (but probably up to approximately 2000 years).**


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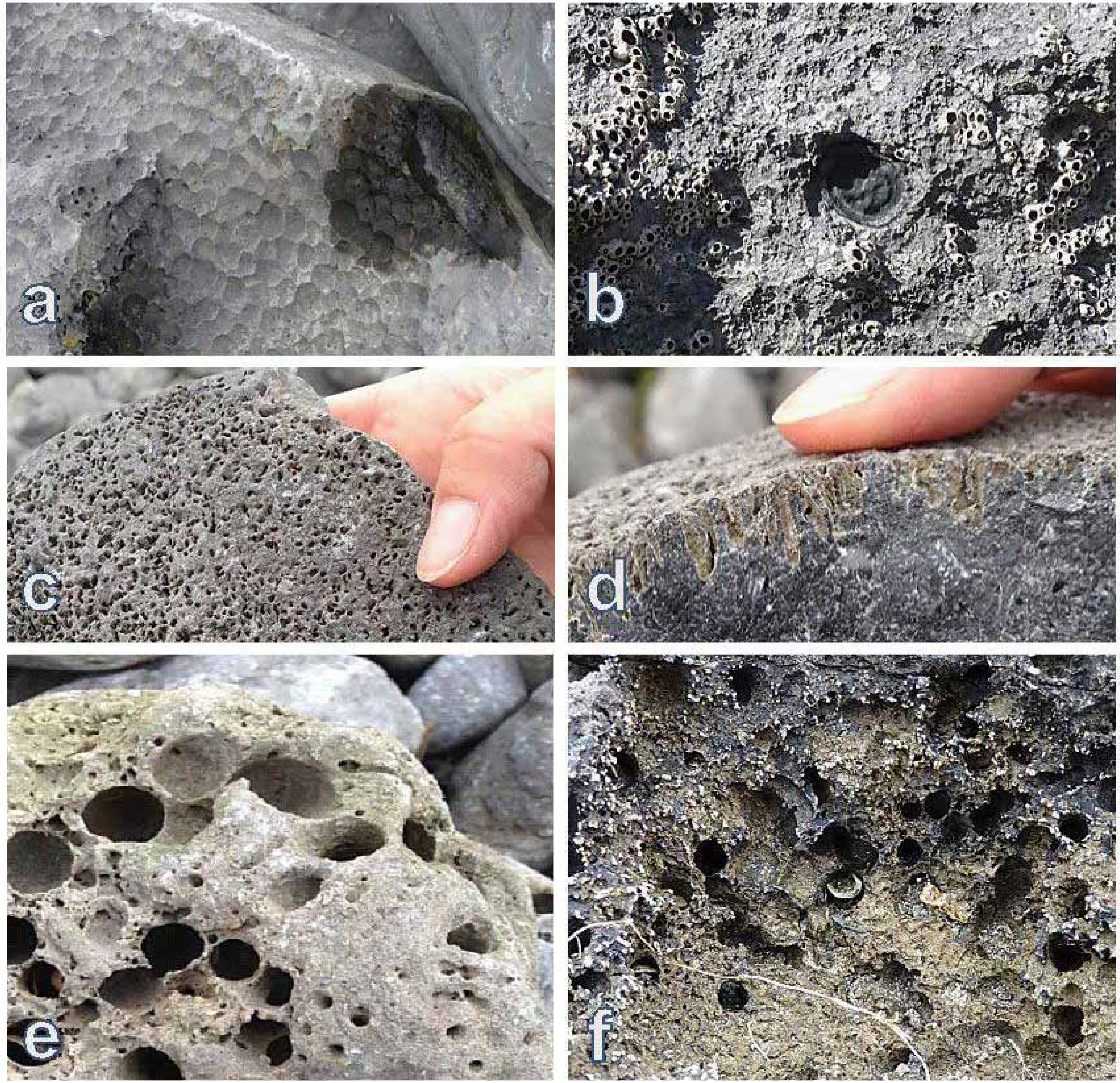


**Figure 9. Biogenic signatures on limestone boulders indicating their level of origin: (a) sea urchin (*Paracentrotus lividus*) home places from the upper subtidal zone; (b) *Patella* home place from the intertidal to the lowermost supratidal zones; (c) and (d) sponge borings (*Cliona lampa*, two aspects) from the subtidal zone; and (e) and (f) *Hiatella arctica* borings from the lower intertidal and upper subtidal zones, some with shells in living position.**


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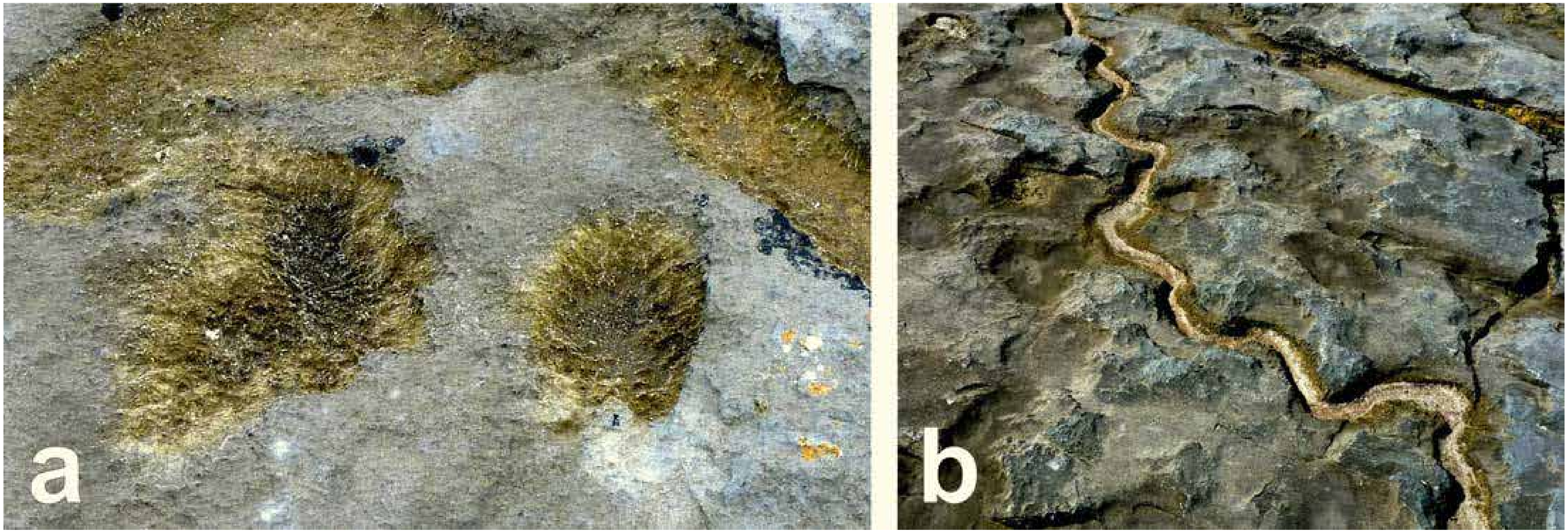


**Figure 10. (a) Rainwater dissolution pools with radial microkarren on Carboniferous limestone. (b) Meander karren, 8 cm deep. The scene here is 2 m wide.**


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**Figure 11. (a) and (b) Landward steep slopes of imbricated boulder ridges built by tabular fragments of many tons (up to 20 tons) in mass at Lafkaniska and Murroogh Point. (c) and (d) Imbrication with seaward dipping forms as stable structures against wave run-up (Poulsallagh area).**


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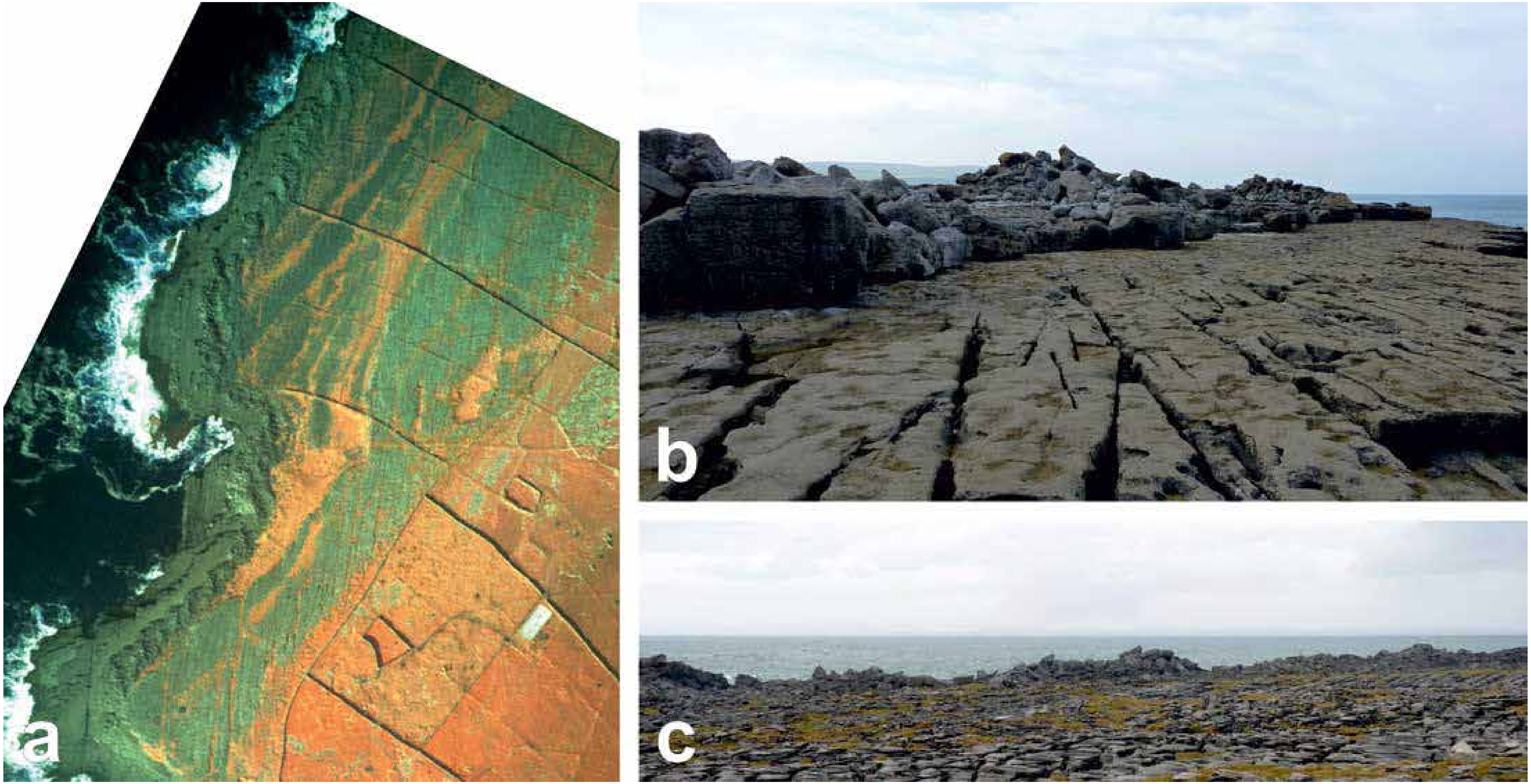


Figure 12. (a) Cliff platform and boulder ridge with individual curved ridge segments from Doolin Point to the north, 8 to 10 m above MHW. The scene is nearly 1 km wide (Marine Institute, 2000). (b) The same location: three secondary cross ridges. (c) Four secondary ridges across the main ridge north of Murroogh Point.


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Figure 13. (a) and (b) Terracelike stratified washover deposits under strong lateral erosion. Examples are from south of Poulsallagh, 8 m above MHW and approximately 70 m inland of the MHW line. (c) Approximately 1.5 km south of Lackglass, stratified sand and silt are preserved 16 to 18 m above MHW and up to 50 m from a cliff top, with 0.3 m of silty sand at the base and 0.3 m of slightly stratified fine to medium sand with fine shell hash on top.


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**Figure 14. (a) Exposure of chaotic marine sediment at a storm cliff south of ridge C at Poulsallagh on reddish clay (81% silt and clay with granules of quartz and feldspar, and only 1% C, polymodal poorly sorted, symmetrically skewed, and platykurtic; a similar "red clay" at the base of the inactive Doolin dunes has been dated by Williams and Doyle, 2014, to 6636–6440 cal BP). The base is a thin layer of LGM ground moraine. (b) A closer look exhibits well-rounded cobbles, pebbles, granules, shell fragments (marked by circles), and a larger mud clast. The largest *Patella* shell (upper left) is dated to 2775–2695 cal BP.**

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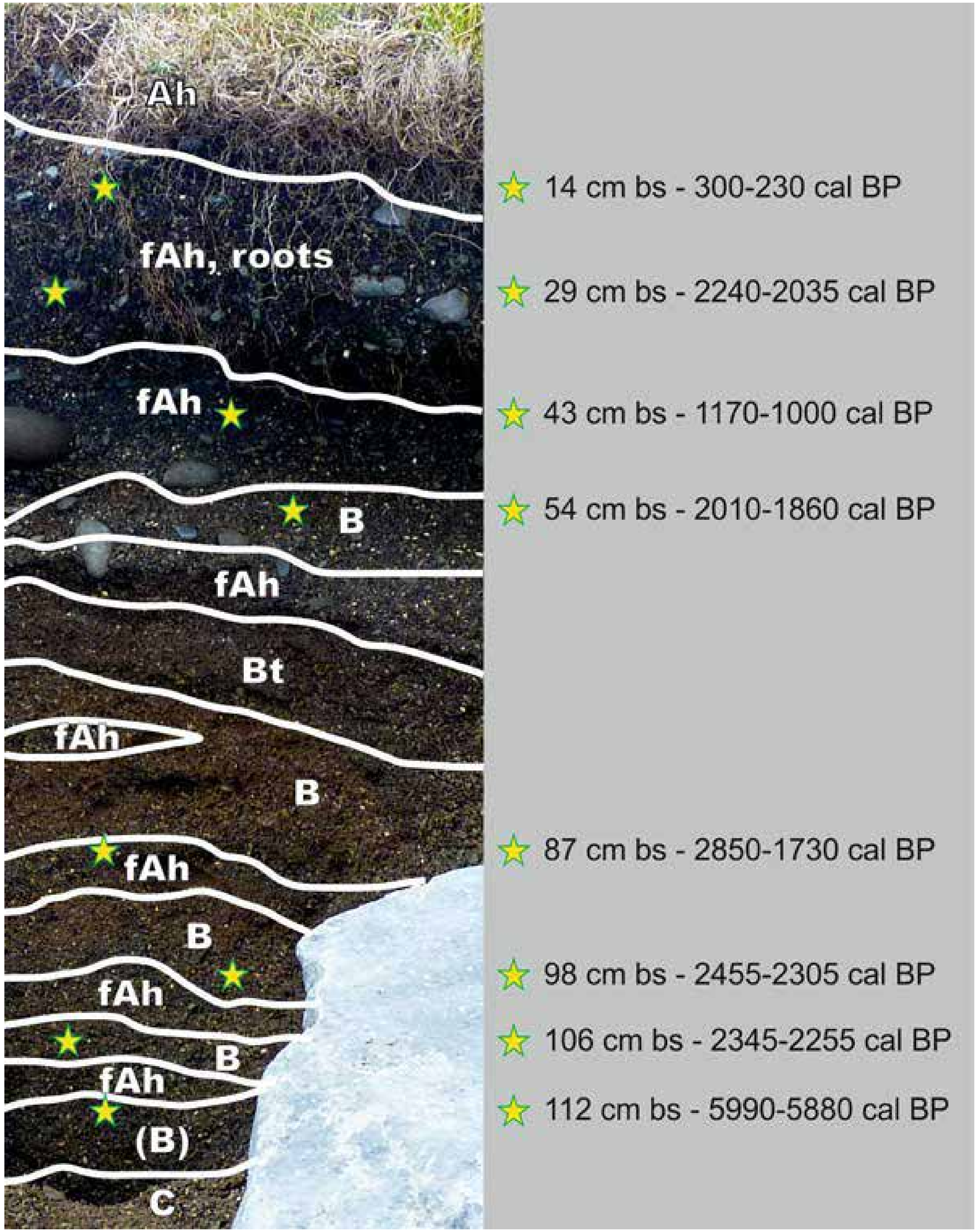


**Figure 15. Section more than 1.2 m deep and 7 to 8 m above MHW 80 m from the MHW line south of Cancapple (ridge B). Oriented cobbles occur in the upper section, and granules with remnants of several soil horizons form the main deposit. The history of sedimentation is complex, showing data inversions, an old base datum, and a young top datum. A tentative interpretation may show at least four events: the oldest up to and around 5990–5880 cal BP; a younger one from 2345–2255 cal BP, taking deposits at least from 2850 cal BP on; another one at a maximum age of 1170 cal BP, moving sediments back to 2240 cal BP; and a last and young one between 300 and 230 cal BP. The difference in disturbed soil remnants between 54 and 87 cm below the surface supports this rough event history but does not fully tell the story.**


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Figure 16. (a) Terracelike deposit south of Murroogh Point built by more than 80% of angular shell fragments (1–1.5 mm), juvenile gastropods, and less than 20% of granules and coarse sand, partly well rounded. The site is 4 m above MHW and 40 m from the MHW shoreline behind a ridge of large old boulders, and it exhibits no clear stratification. (b) Shell fragments dated 2130–1985 cal BP from 63 cm below the surface. (c) Juvenile marine gastropods (longest is 8 mm) from 75 cm below the surface, dated 2730–2605 cal BP.


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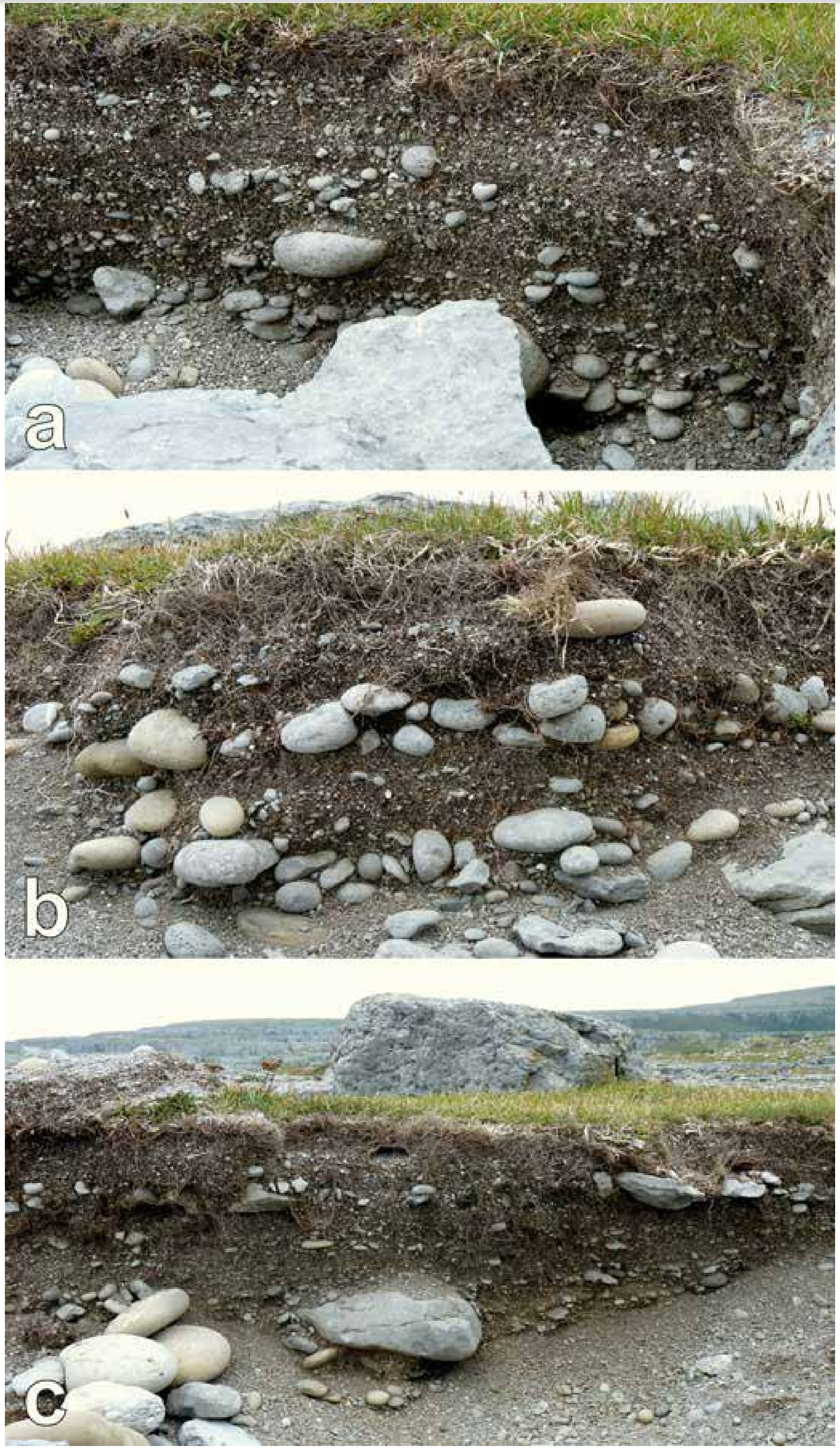


**Figure 17. Stratified coarse sand, cobbles, and small boulders between Cancapple and Poulsallagh (compare Figures 1, 2, and 13). The geoarchives are 0.4 to 1.3 m deep and based on medium boulders, including those with *Hiatella* borings. Most pebbles and cobbles are clearly oriented, but stratification changes laterally within meters and sorting is generally bad. Samples of marine gastropods show consecutive data according to depth below the surface (bs):**

33 cm bs = 1180–1040 cal BP
36 cm bs = 1170–1000 cal BP
43 cm bs = 1730–1565 cal BP
93 cm bs = 2345–2255 cal BP


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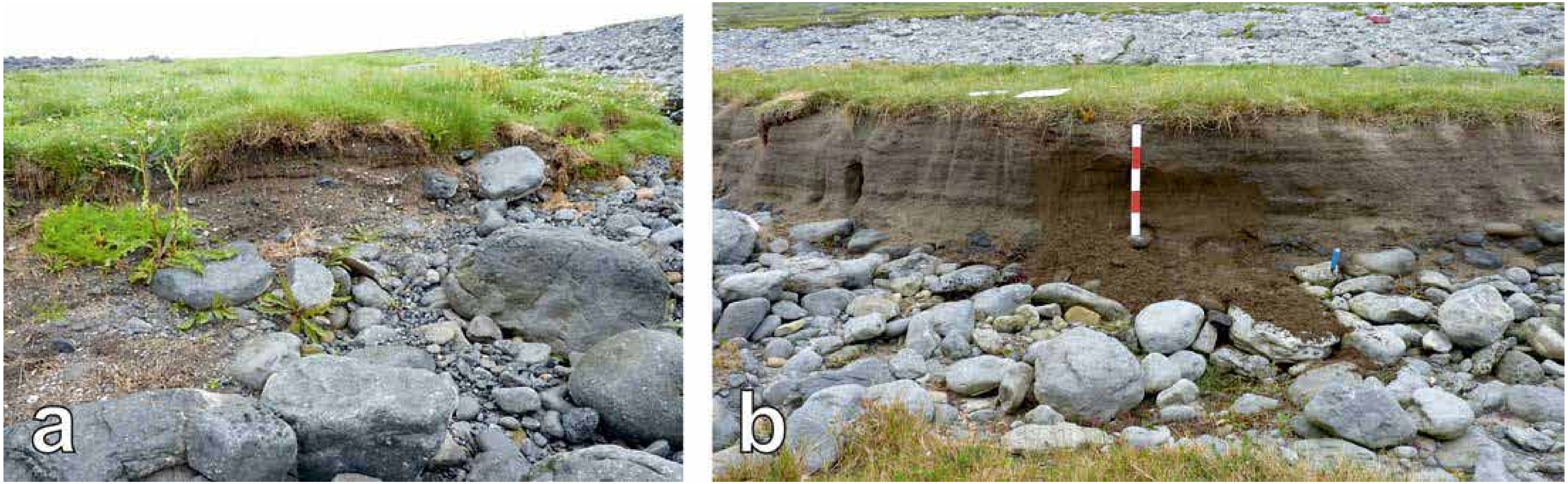


**Figure 18. Two aspects of fine stratified sediments at Lafkaniska around 2.5 m above MHW and 30 to 40 m from the coastline based on rounded marine boulders.(a) Coarse sand with pebbles, shell hash, and preserved gastropods. (b) Stratified silt to medium sand with fine shell hash and single gastropods. This deposit has a maximum thickness of 0.9 m (scale of 0.5 m), contains 6% clay, and shows a brown soil over its vertical span. Gastropods from the same layer at 35 cm below the surface gave ages of 315–245, 265–70, and 250–0 cal BP.**


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**Figure 19. Three fining upward sequences in coarse sand and granules at Murroogh Point behind the seaward boulder ridge. Numerical data (AMS) are ordered by their depth below the surface (bs) with a "normal" age sequence, although stratification is less developed:**
**10 cm bs = 1095–940 cal BP**
**20 cm bs = 1980–1825 cal BP**
**34 cm bs = 2325–2150 cal BP**


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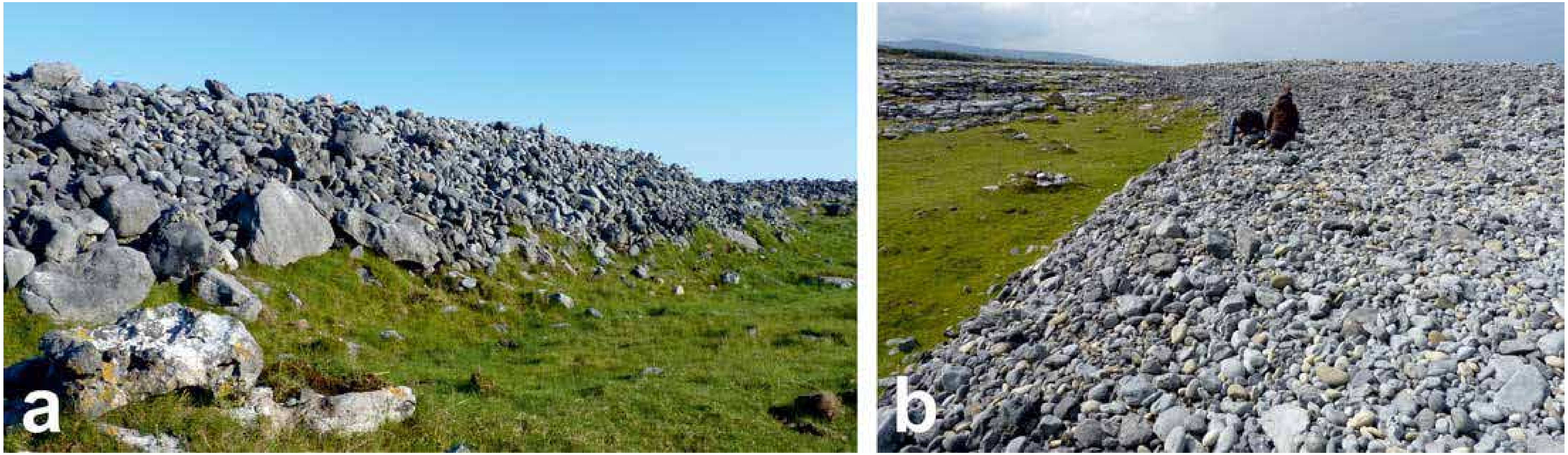


**Figure 20. (a) The landward flank of the southern washover feature at Murroogh Point, looking to the north. Vegetation and soil mantle of the lower parts document a lack of recent boulder sedimentation or landward movement. (b) Landward flank of the northern Murroogh Point boulder tongue, looking southward, with a sharp boundary with vegetation and soil (sitting people for scale).**

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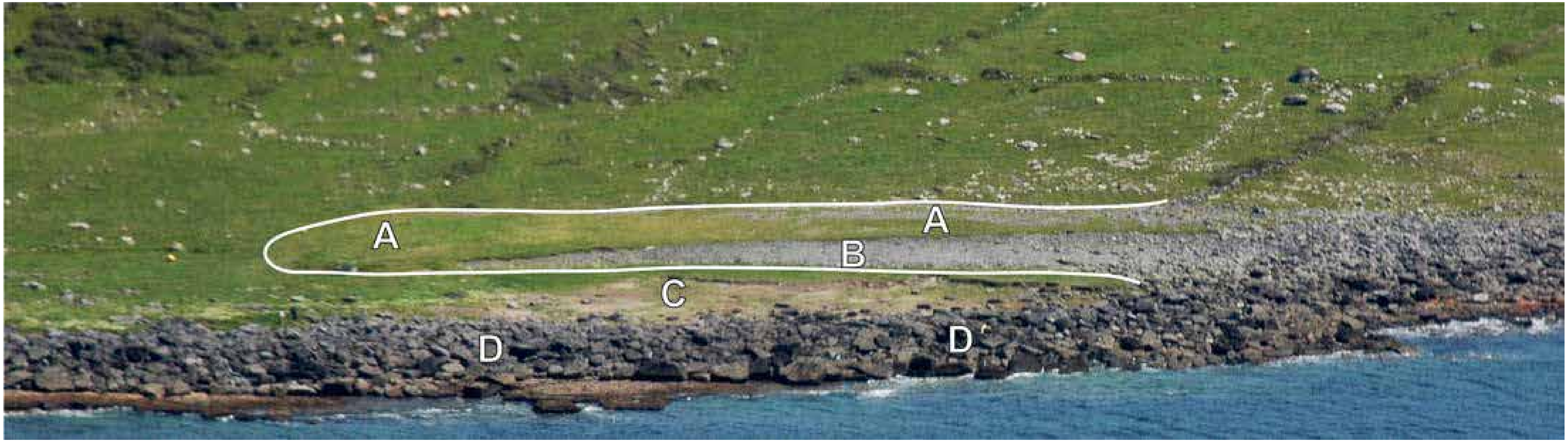


**Figure 21. The Lafkaniska northern washover lobe seen from the west (oblique aerial photo). The nearshore is shallow, with a 20-m depth at a distance of 400 m from the modern MHW line and a 10-m depth at 200 m. A: Tongue of medium boulders, dislocated from the south (right). B: Sharply eroded western flank of the washover lobe. C: Stratified sand and silt with pebbles and shells under strong lateral erosion. D: Stable and well-imbricated ridge of large angular boulders (approximately 2 to 15 tons) on limestone base rock.**


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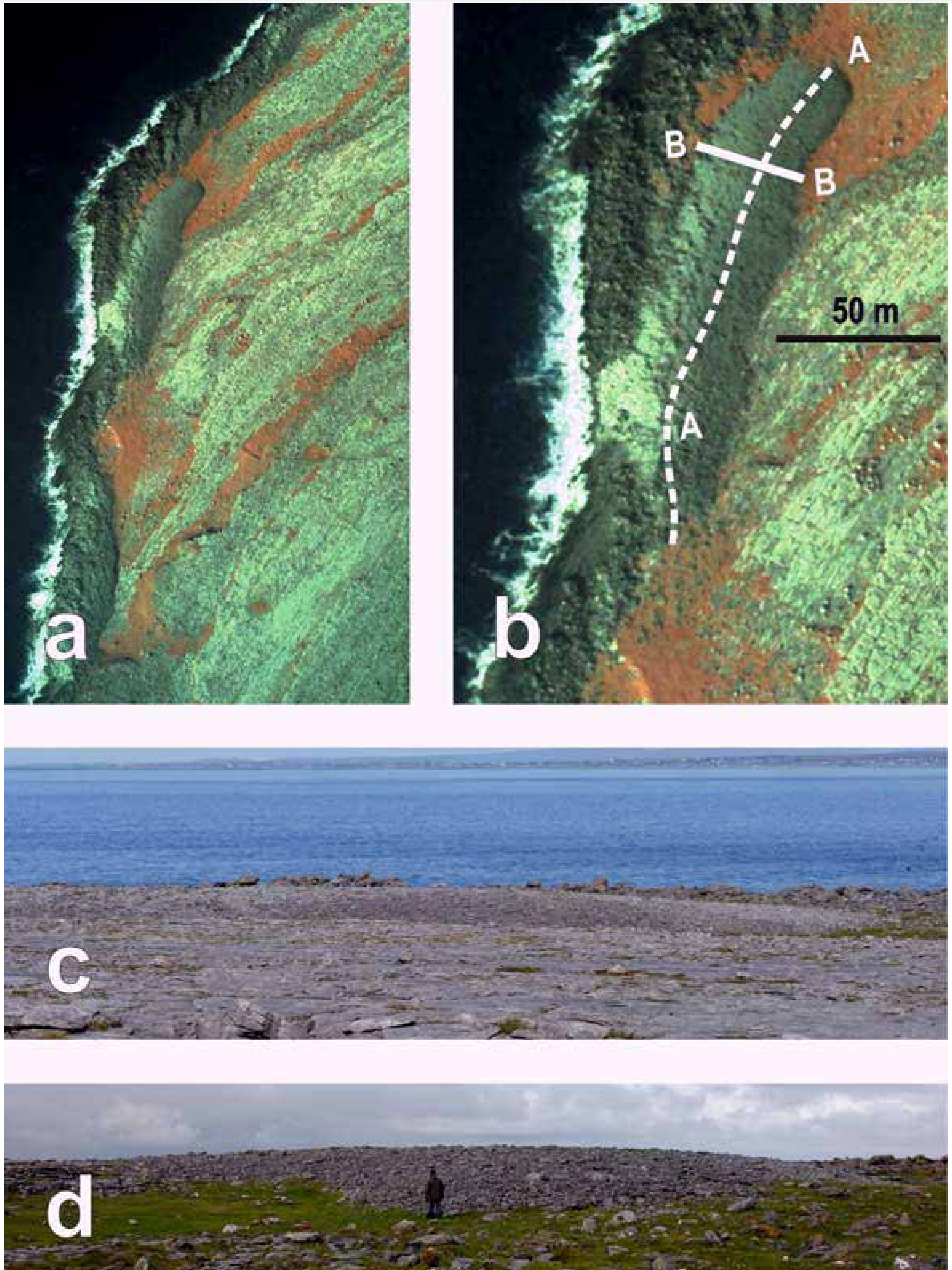


Figure 22. (a) Two washover lobes at Murroogh Point, with the northern as a boulder tongue and overforming by curving secondary ridges of large boulders (formed from the direction of 1008) at the southern lobe. The northern lobe exhibits activation in its SW part close to the sea (Marine Institute, 2000). The southern Murroogh Point washover has a total length of 170 m and a maximum width of 45 m; the main axis is to 218. The form is fringed by a straight rock step at the inland slope. (b) Northern washover tongue at Murroogh Point with crestlines A and A0 and profiles B and B0 (Marine Institute, 2000). (c) Northern washover tongue (length of 120 m, highest elevation of 6.6 m above MHW, ending to the north or right 2.7 m above MHW) at Murroogh Point parallel to a ridge of very large imbricated boulders to seaward (seen September 2015, looking from the east). Seaward sections exhibit light colors from activation during storms of the season 2013–14. (d) Cross-sections B and B0 seen in 2007 from the north with a width of 32 m, a maximum elevation of 6.3 m over MHW, a base at left (east) 2.7 m above MHW and at right (west) 3.7 m above MHW.

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**Figure 23.** ***Hiatella arctica*** **(>1 cm long) from washover lobes: (a) Lafkaniska dated 5715–5580 cal BP, (b) northern Murroogh tongue dated 4980–4810 cal BP, and (c) from younger activation of the Murroogh Point tongue dated 690–620 cal BP.**


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**Figure 24. A storm cliff in slightly consolidated dunes of Fanore showing a partly sigmoidal stratification with thin caliche bands of a former leeward exposure (to NW). Scale is 0.5 m. The sediment character is a unimodal, moderately well-sorted medium (59%) sand, symmetrically fine skewed and leptokurtic.**


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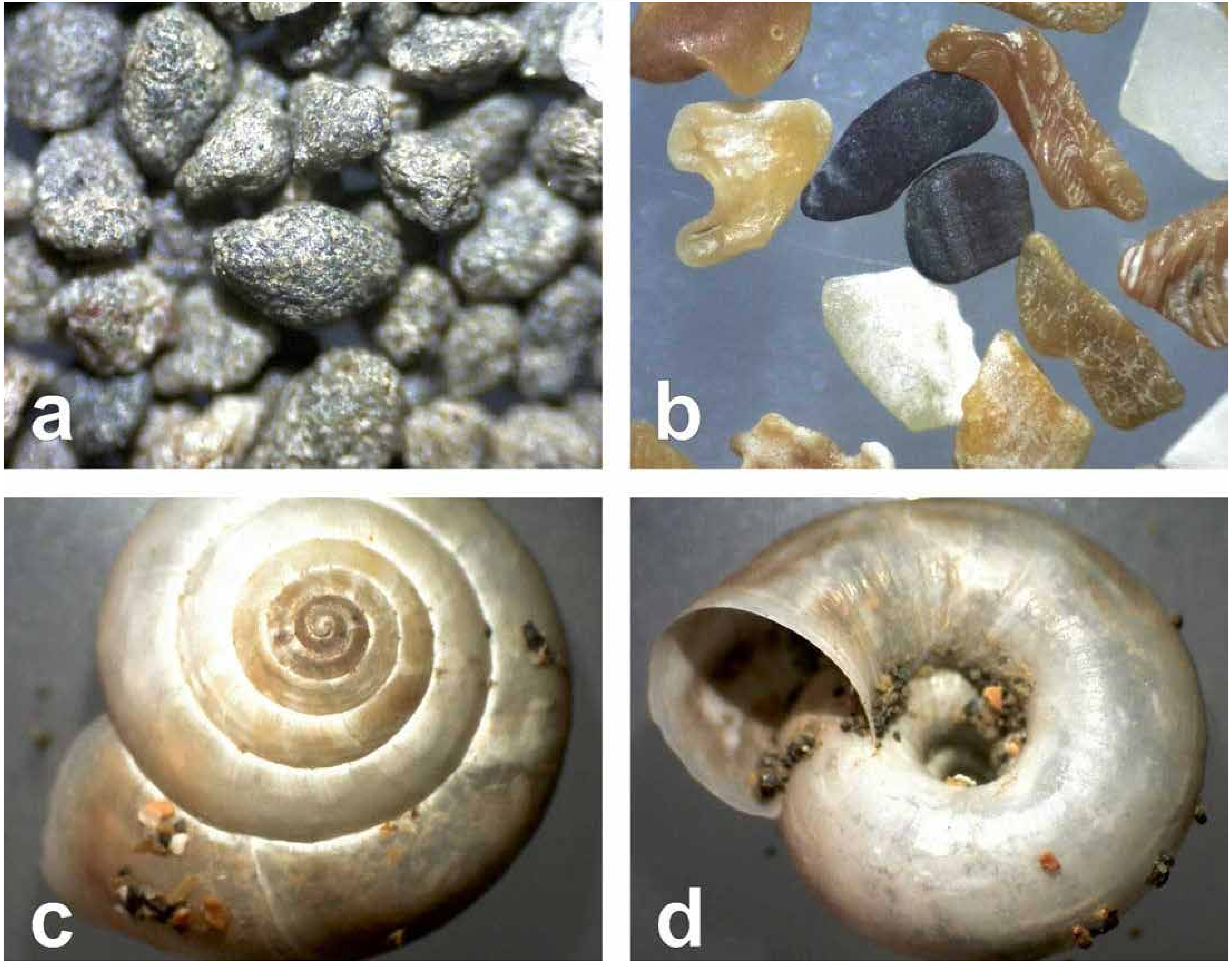


Figure 25. (a) Corroded surfaces of rounded quartz grains (0.2–0.5 m, 603) from old Fanore dunes. Similar aspects are found in the Doolin dunes. (b) Modern beaches may exhibit rounded shell fragments and sand grains (here 1–2 mm). (c) and (d) Terrestrial gastropods (*Helicodonta obvolata,* size 1.5 cm) from the Fanore dunes, ages between 3905–3820 and 3455–3365 cal BP.


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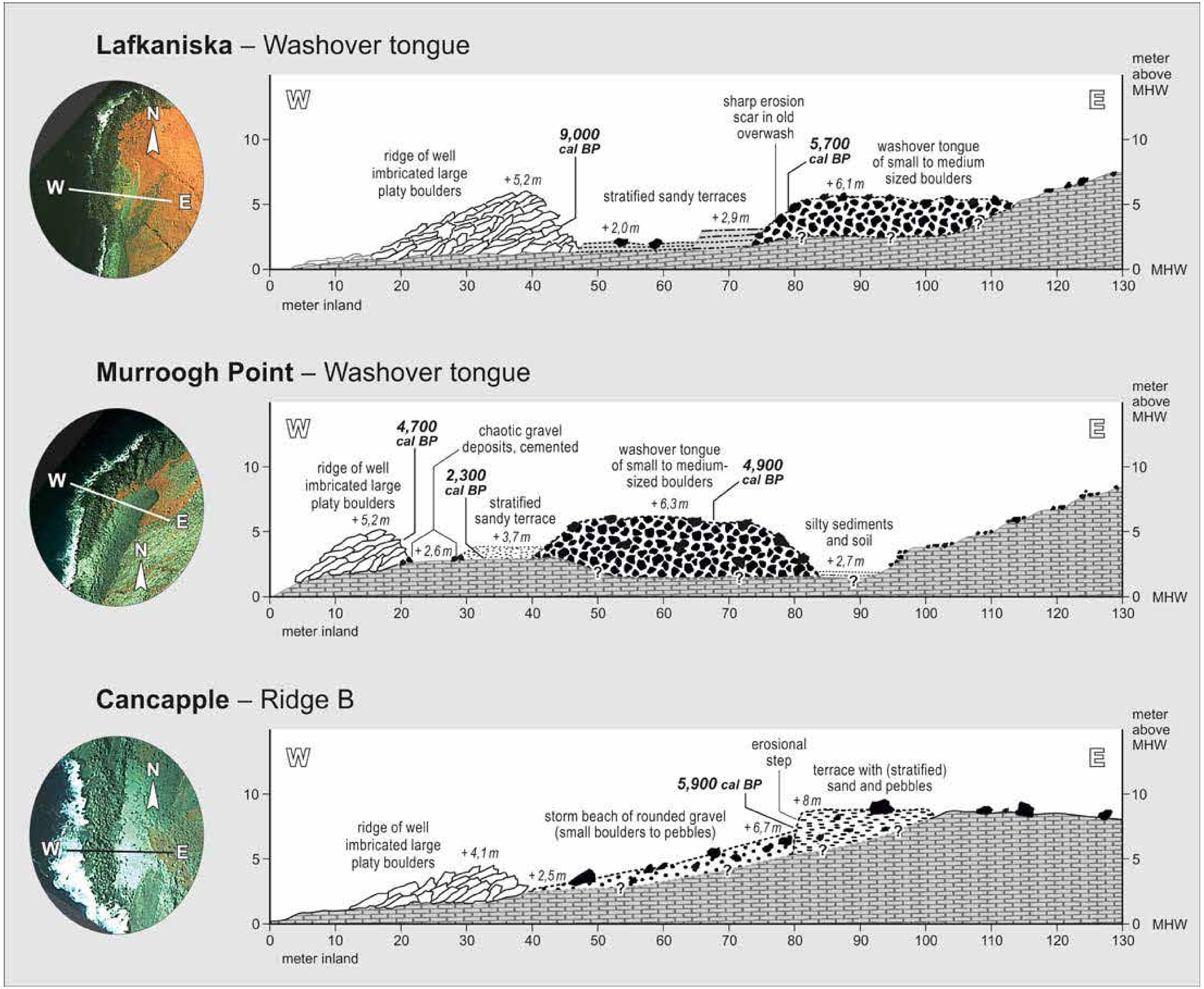


Figure 26. Three profiles over main sedimentary units along the Doolin–Black Head coastal section inside Galway Bay (infrared aerial photos: Marine Institute, 2000; graphics: Gudrun Reichert).


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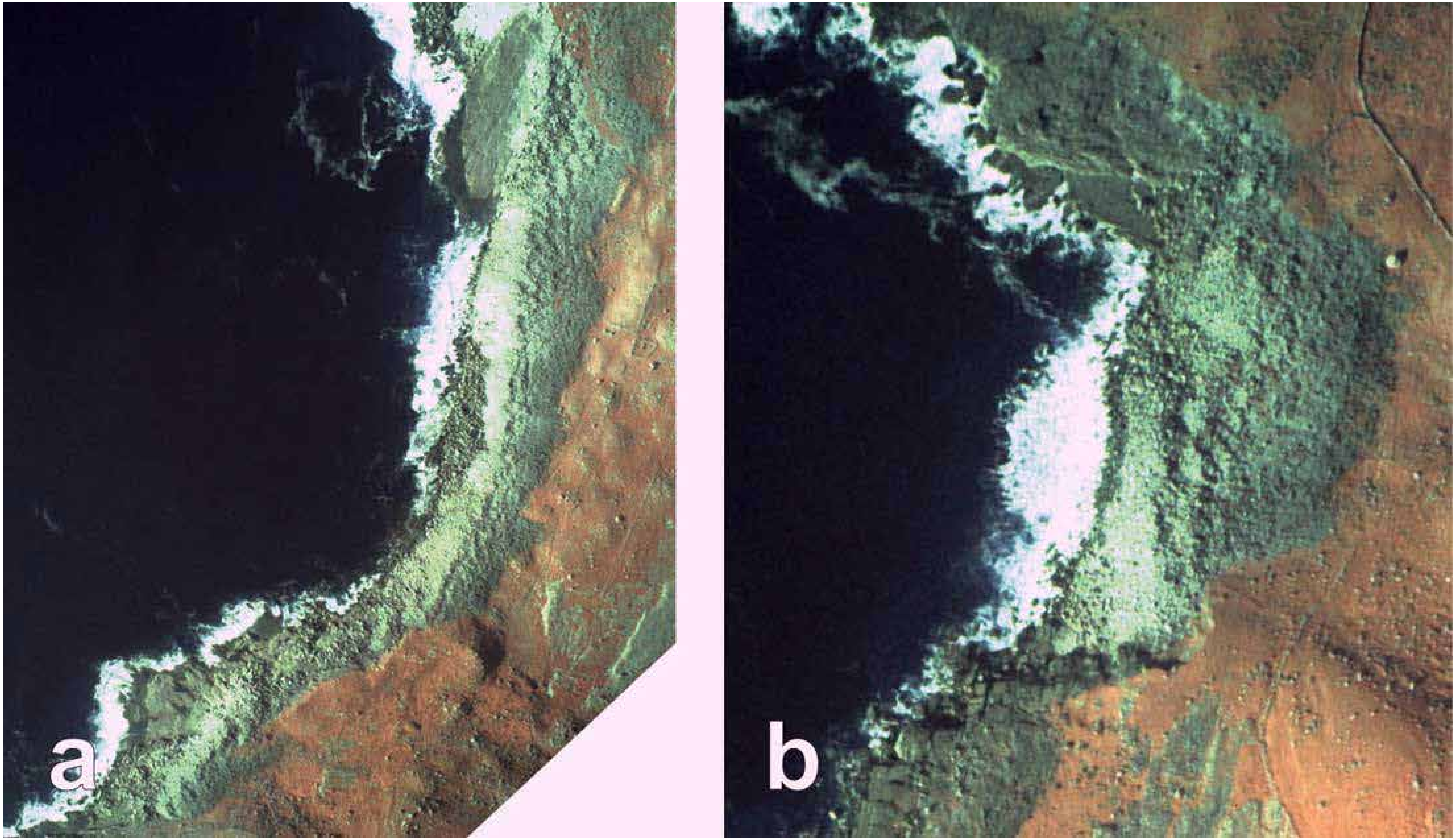


**Figure 27. The widest beach ridges (washover features) of coarse gravel and boulders occur between Poulsallagh and Cancapple on the SE coast of Galway Bay. (a) The left ridge (ridge B) is 55 m wide, and (b) the right ridge (ridge C) is 65 m wide. Their darker-colored landward slopes exhibit ripplelike surface patterns from overflow with cord lengths and widths of several meters, whereas the relief between is approximately 0.5 to 0.8 m (Marine Institute, 2000).**


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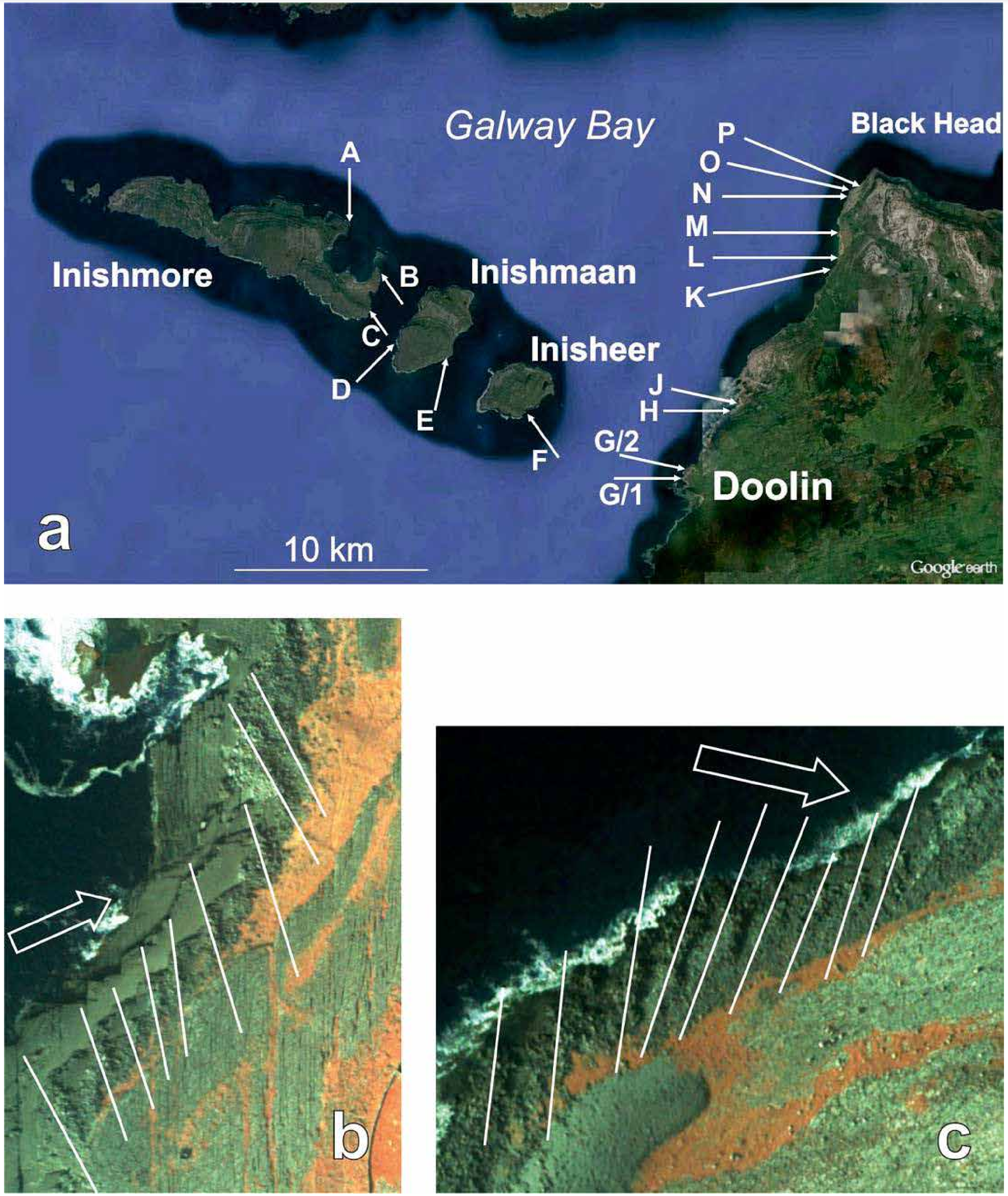


**Figure 28. (a) Sites, where main ridges of large boulders are dominated by secondary cross-running ridges. Arrows (A–P) indicate direction of energy approach (from WSW to WNW between Doolin and Galway Bay) (Google Earth, modified). (b) Example of a coarse boulder clifftop ridge (point G1 in a) is 8 to 12 m above MHW, running north from Doolin Point, with nine cross-running secondary and slightly curved ridges (marked by thin white lines) along a section 450 m long. The energy approach to form these secondary ripples by a strong current is marked by an arrow (Marine Institute, 2000, modified). (c) Secondary cross-running ridges (marked by thin white lines), forming the main large boulder ridge at Murroogh Point (point O in a) close to MHW level. The section shown is about 250 m long. The energy approach of a strong current to form these secondary ridges is marked by an arrow (Marine Institute, 2000, modified).**


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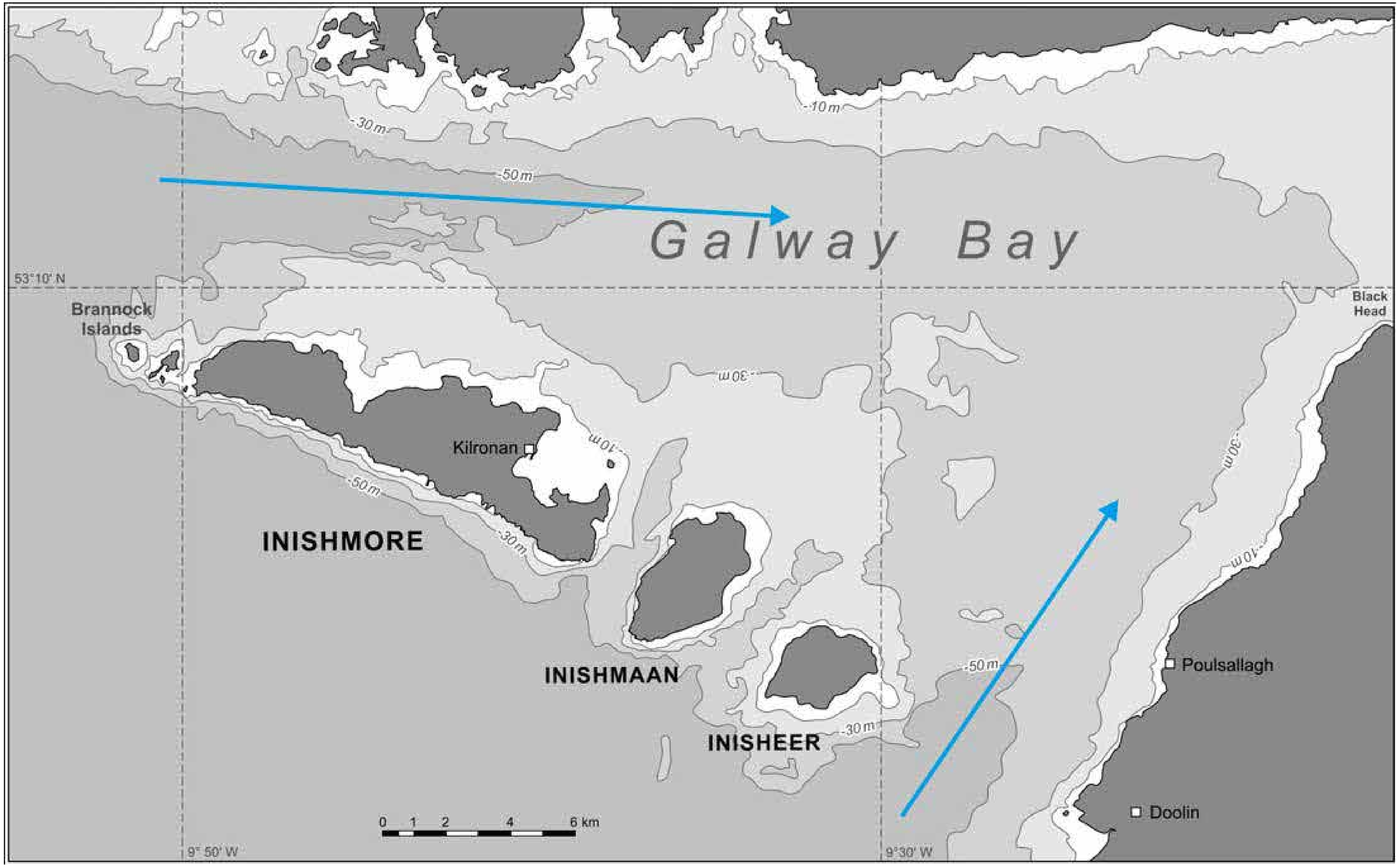


Figure 29. Bathymetry around the Aran Islands and in Galway Bay. Extreme flow processes (*e.g.*, tsunamis, blue arrows) may move through North Sound from a direction of 2738 and through South Sound from a direction of 2108 (bathymetry: British Admiralty, 2005). Because driving forces to organize the crossway ridges on large boulders came from WNW to WSW, flows crossing both sounds (with a slight refraction to the right) may have necessary effects on the Doolin–Black Head section (cartography: Gudrun Reichert).

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# Composition and Spatial Distribution of Mesozooplankton along Confinement and Anthropogenic-Impact Gradients in the Gulf of Vlorë (Albania)

# Composition and Spatial Distribution of Mesozooplankton along Confinement and Anthropogenic-Impact Gradients in the Gulf of Vlorë (Albania)

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## ABSTRACT

The composition of mesozooplankton and their space-time distribution in the Gulf of Vlorë (southern Albania, Mediterranean Sea) are described for the first time. Sampling was carried out during two oceanographic cruises (May 2007, January 2008) with two replicates at each of 17 stations at each time, making a total of 68 samples. The study aimed to describe the influence of confinement (defined as distance from the open sea) and anthropogenic impact (defined as vicinity to the east coast of the gulf) on zooplankton composition. A total of 198 *taxa* were recognised in the whole zooplankton assemblage, with only 136 *taxa* common to both periods and only two species present in all samples. Statistical analysis of data distinguished the Mezokanal area (the boundary between the gulf and the open sea) from three other areas inside the gulf. Differences were also found among the areas inside the gulf at increasing degree of confinement. Mesozooplankton varied more sharply with confinement than with anthropogenic impact and yielded more-detailed space partitioning of the gulf than microzooplankton, which had been used in a previous study.

**ADDITIONAL INDEX WORDS**: *Coastal zooplankton, Mediterranean Sea, seasonality, biodiversity.*

## INTRODUCTION

Compared with the open sea, coastal marine environments can be highly variable (Amanieu and Lasserre, 1982; Badosa *et al.*, 2006; Elliott and Quintino, 2007; Mitsch and Gosselink, 1993). A significant decrease in species richness and an increase in specimen number are evident in mesozooplankton along gradients of increasing confinement in harbours, bays and lagoons (Belmonte *et al.*, 2013). In comparison with the open sea, the higher variability of abiotic conditions in confined environments (Guelorget and Perthuisot, 1992) is probably also the reason why organisms have shorter life spans and consequently smaller body sizes (Belmonte and Cavallo, 1997; Belmonte *et al.*, 2013; Blackburn and Gaston, 1994; Uye, 1994). In addition to these features, communities display other indicators of confinement grade. In addition to meroplankton, which are more frequent in coastal areas than the open sea, holoplanktonic copepods of the family Acartiidae are considered indicators of the most coastal and sheltered areas all over the world (Razouls, 1995). Due to the common presence of human activities and settlements in confined coastal areas, the effects of anthropogenic pressure are not easily distinguishable from those of confinement, with which they combine.

The Gulf of Vlorë was chosen as a study site to evaluate the roles of confinement and anthropogenic pressure on the plankton community because their gradients do not coincide. With no preceding studies of physical aspects (*e.g.*, water renewal, hydrodynamism), confinement was assumed to be inversely related to distance from the open sea (Guelorget and Perthuisot, 1992), corresponding to a NW-SE axis. Anthropogenic pressure was considered to be inversely related to distance from the urbanised side of the gulf, along an E-W axis, roughly perpendicular to that of confinement. Moscatello *et al.* (2011) studied microzooplankton and phytoplankton communities in the same area


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with the same aims; of the microzooplankton, ciliates appeared to be the best descriptors of the system's heterogeneity.

The Gulf of Vlorë is geographically delimited by coasts with different characteristics. The east coast is rocky and is affected by the city of Vlorë and the recent (beginning 7 years before execution of the sampling presented here) rise of tourism-based development (about 54 hotels), which has enhanced the sedimentation rate, thus producing problems for the inshore benthos (Fraschetti *et al.*, 2011). The southern coast is flat; its features include Pasha Liman Lagoon and the mouth of the River Dukat. The western coast of the gulf is delimited by the Karaburun Peninsula, which is rocky and steep and without human settlement (originally a military zone, it has been abandoned since 1990). The present study aims to confirm spatial diversification in the gulf by using organisms with a longer life span and larger body size than the unicellular plankton used by Moscatello *et al.* (2011). The lack of studies of mesozooplankton in the Gulf of Vlorë (one of the lesser-known bays on the European side of the Mediterranean) means that research will also be of faunal interest. Indeed, Albania's political isolation in the second half of the 20th century effectively prevented scientific exchanges of opinions and even environmental studies. Consequently, even simply descriptive studies (such as those examining the presence of species) are lacking for this area.

Although detailed studies of the mesozooplankton community in the Gulf of Vlorë are not available, the zooplankton composition and distribution can be compared with those of other bays on the Balkan side of the South Adriatic Sea. In the second half of the 20th century, various authors (Gamulin, 1979; Hure and Scotto di Carlo, 1968; Lucic and Onofri, 1990; Regner, 1985) reported the composition of mesozooplankton in the south Adriatic bays of former Yugoslavia. Miloslavic *et al.* (2012) recently studied Albanian waters, although mesozooplankton composition was described on the basis of just one station close to the coast, near the Bay of Drin (north Albania). These studies, together with recent studies of the region's phytoplankton and microzooplankton (Moscatello *et al.*, 2011; Rubino *et al.*, 2013), represent a point of reference and comparison for discussion of the seasonal and spatial distribution of mesozooplankton in the Gulf of Vlorë.

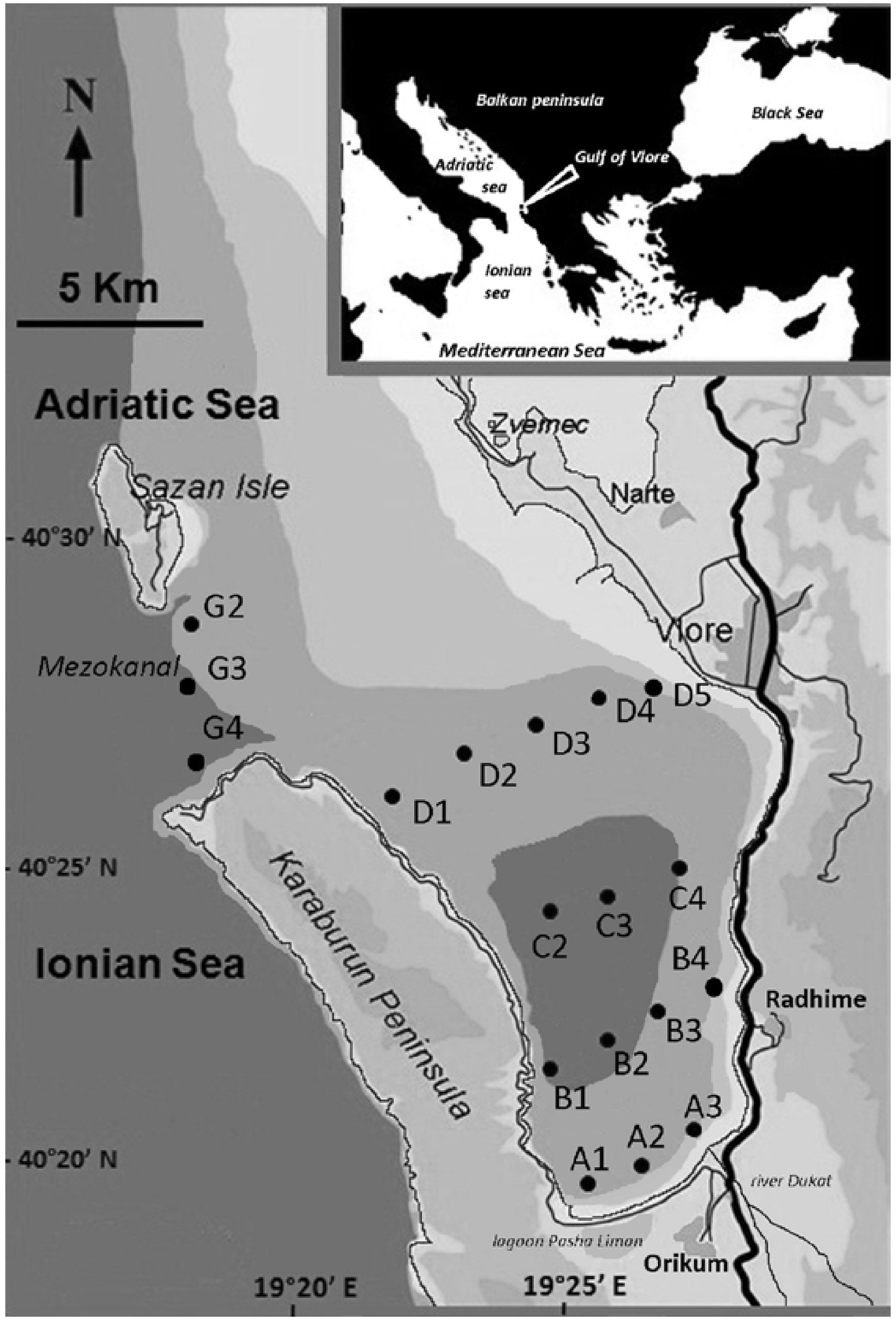


**Figure 1. Map of the study area (Gulf of Vlorë, SE Albania) showing position of 18 sampling stations aligned along 5 transects (A, B, C, D, G). Station D5 not sampled in May 2007; station B3 not sampled in January 2008. Different shades of grey indicate different depths in the gulf: –10 m, –20 m, and –50 m.**

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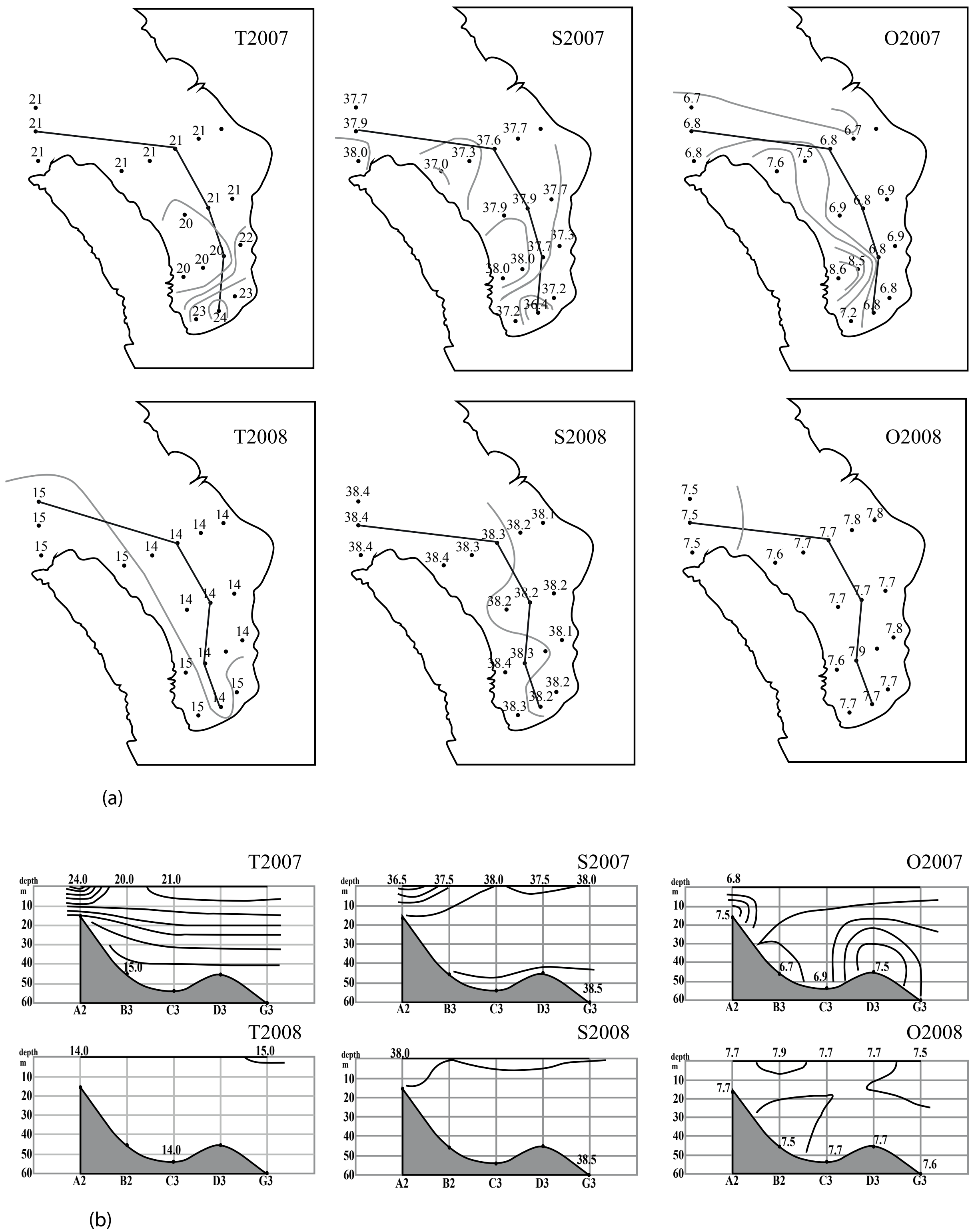


**Figure 2. (a) Surface distribution of temperature (°C), salinity (‰), and dissolved oxygen (ppm) values in the Gulf of Vlorë in May 2007 and January 2008. (b) Vertical distribution of temperature (°C), salinity (‰), and dissolved oxygen (ppm) values in the Gulf of Vlorë along alignment of stations G3-D3-C3-B3-A2 in May 2007, and G3-D3-C3-B2-A2 in January 2008 (see Figure 2a for the section track).**

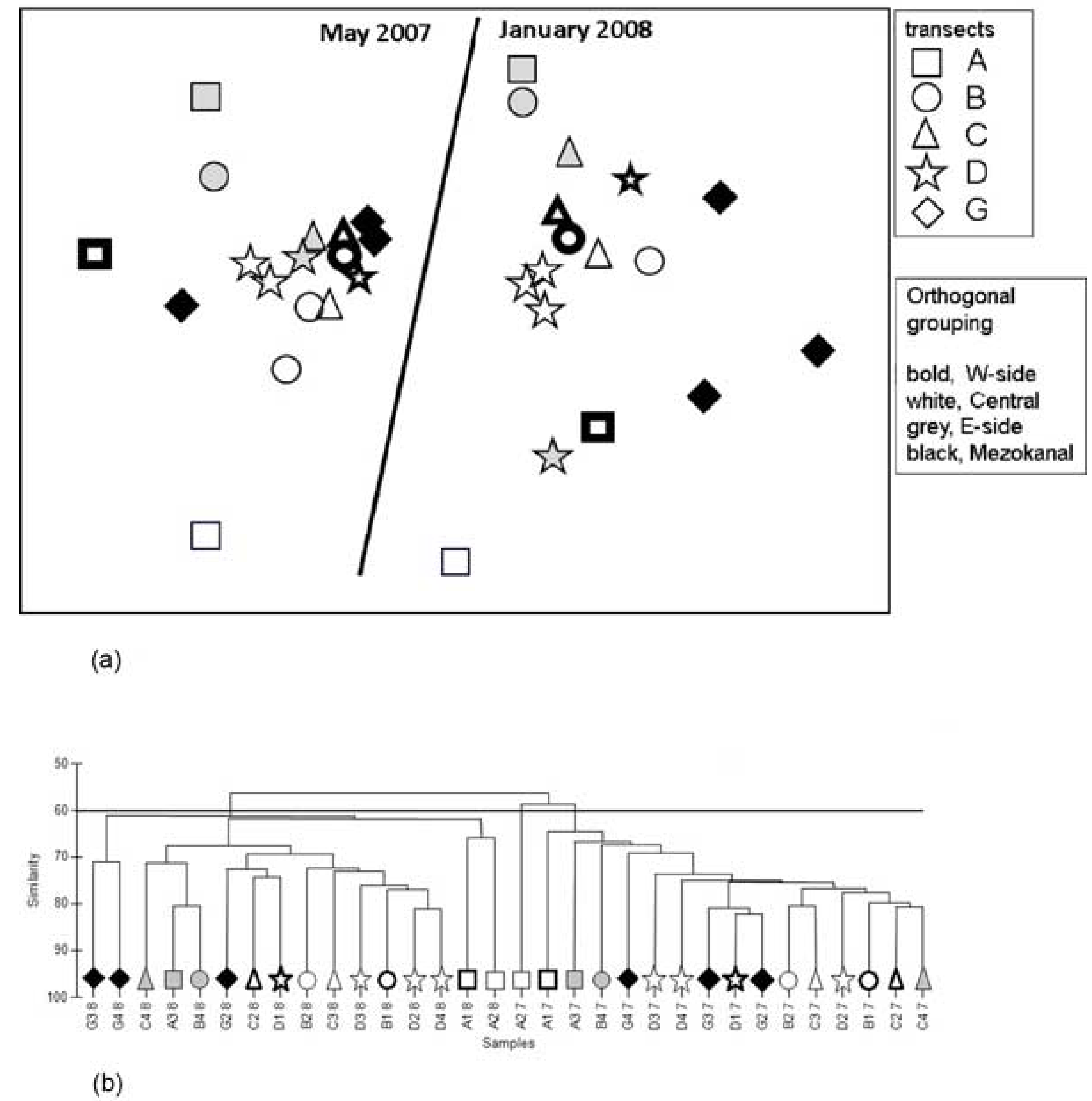


**Figure 3. Representation of nonparametric multidimensional scaling (nMDS) (a) of mesozooplankton samples collected in Spring 2007 and Winter 2008, with superimposed cluster (b) at similarity level of 60%. Data fourth-root transformed. 2-D stress: 0.13. A, B, C, D, G represent transects from inner bay to open sea. Numbers (1–5) added to each letter represent sampling stations. Numbers 7 and 8 represent year of collection (2007 and 2008). Bold-bordered, grey, white, and black symbols in the nMDS representation (a) and in the cluster (b) denote west, east, central, and Mezokanal stations, respectively.**


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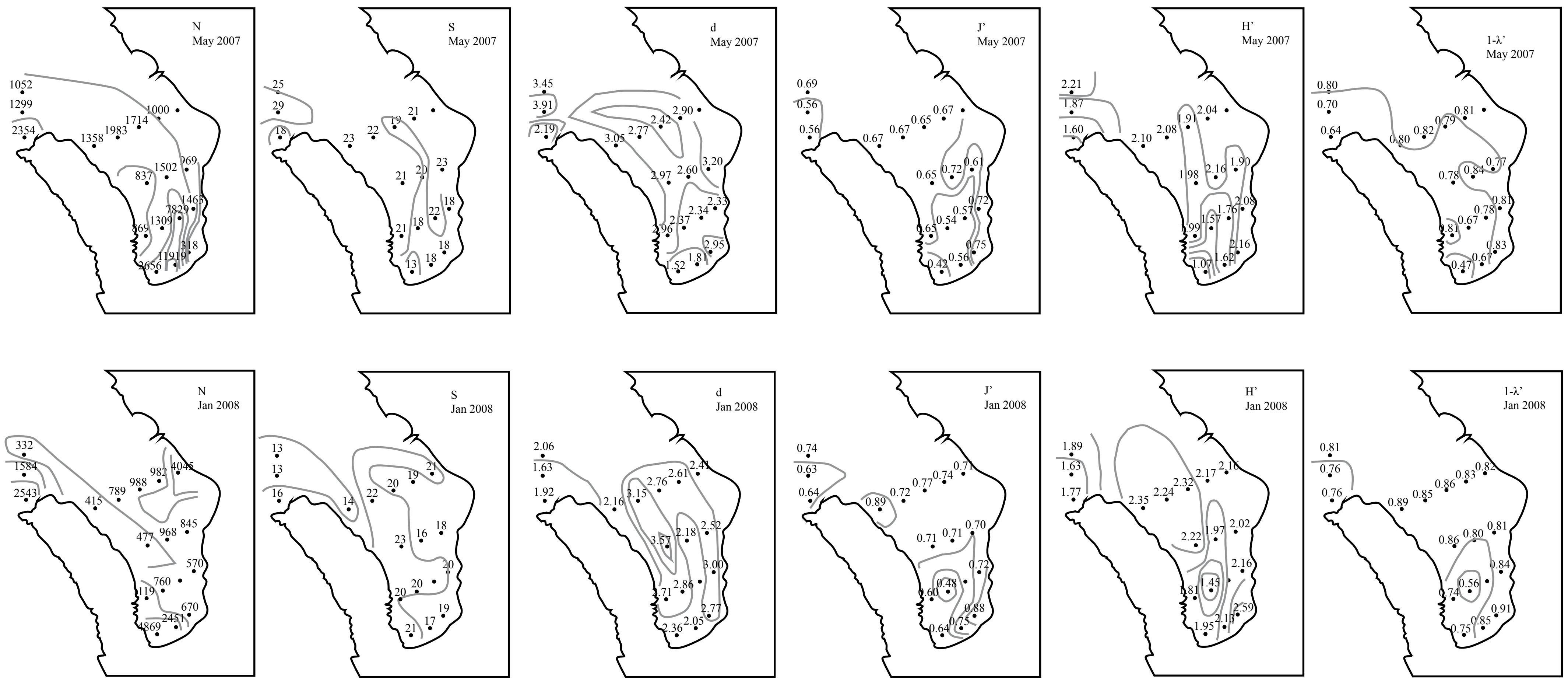


**Figure 4. Distribution of values of main diversity descriptors calculated from data on 42 species found in 18 stations in two periods (May 2007 and January 2008). S, species richness; N, numerical abundance; d, Margalef's diversity index; J0, Pielou's evenness; H0, Shannon-Wiener diversity index; 1-k, Simpson's diversity index.**

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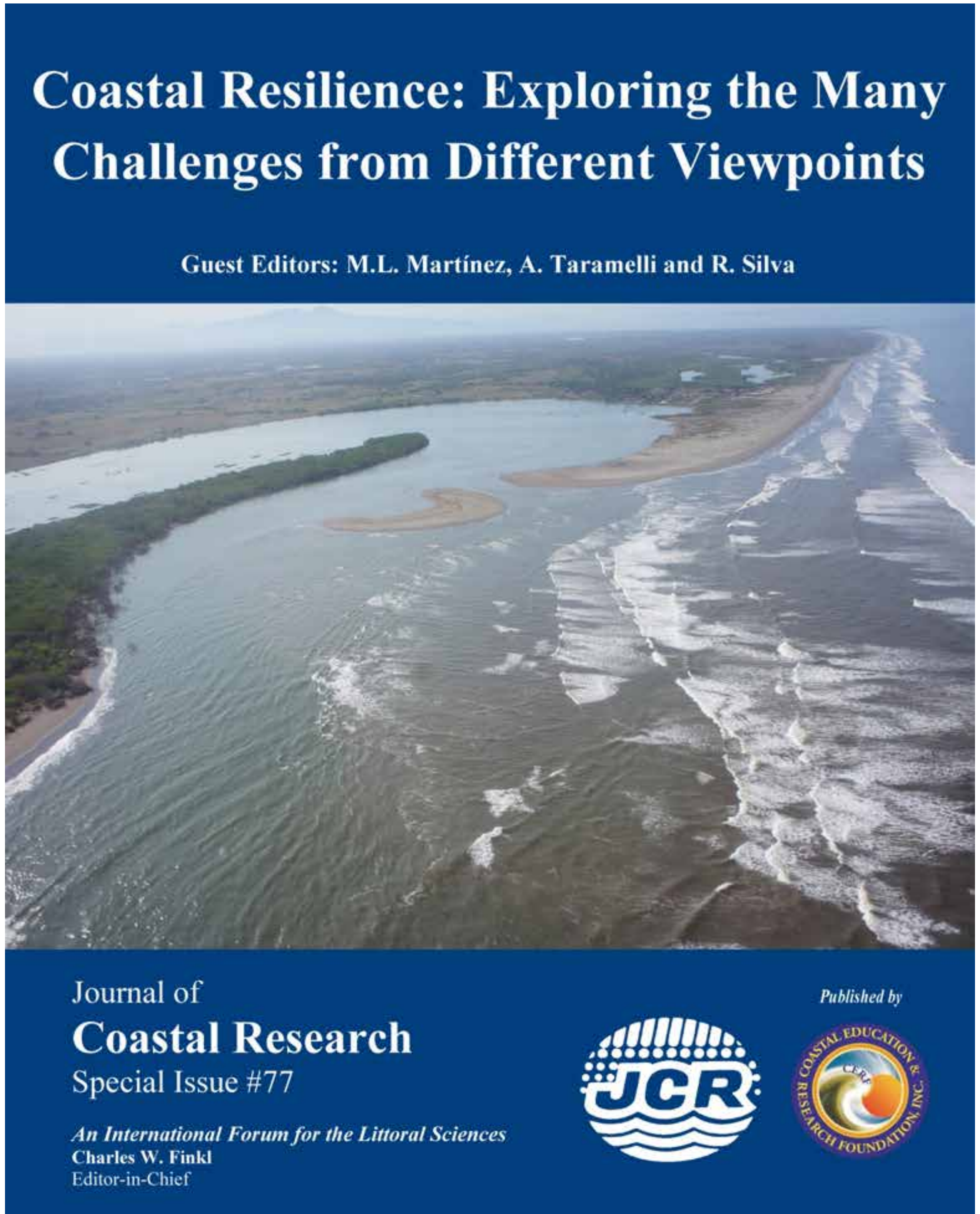


# Cover image:
# Boca de Camichín, Nayarit, Mexico

Cover image: Boca de Camichín, Nayarit, Mexico. At the mouth of the San Pedro River, fresh and salt water mix, giving life to 92,000 hectares of mangroves and lagoons, an area known as Marismas Nacionales. A dynamic equilibrium has been maintained in the area over the last 7,000 years, despite changes in sea level, with deltas, tidal channels, flood plains and marshlands providing habitats for a rich variety of flora and fauna. For hundreds of years, an abundance of prawns and oysters have been harvested here, even though a permanent human settlement has only existed for the last 50 years. A local population of just over 1000 live primarily by fishing and agriculture. (Photograph taken by Rodolfo Silva Casarín, Instituto de Ingeniería, Universidad Nacional Autónoma de México.)

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# DISCUSSION

## Discussion of: van Gaalen, J.F.; Tebbens, S.F., and Barton, C.C., 2016. Longshore Sediment Transport Directions and Rates from Northern Maine to Tampa Bay, Florida: Literature Compilation and Interpretation. *Journal of Coastal Research,* 32(6), 1277–1301.

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The paper by van Gaalen, Tebbens, and Barton (2016) was brought to our attention as a citation in an undergraduate thesis. We read the paper, looking forward to an up-to-date compilation of the literature on longshore transport on the U.S. East Coast. However, we were disappointed that the paper (1) contained inaccurate information regarding the location cited by the student; (2) is based largely on older references; and (3) biased toward non–peer-reviewed publications.

The reference pertinent to the undergraduate's work was in Saco Bay, Maine, in which a 1956 Army Corps of Engineers report is cited to claim that sand for the beaches traveled south toward an old jetty at the mouth of the Saco River (USACE, 1956); this is actually cited by the Army in numerous reports as a 1955 report (USACE, 1955). This southerly transport of sand was part of the justification the Army made 150 years ago to construct a jetty at the mouth of the Saco River and to lengthen it greater than a mile. Great property losses in the vicinity of the jetty led local people to complain about the structure, which has long since outlived its original industrial purpose and resulted in numerous studies of the sand movement in the bay by ourselves and a number of colleagues. In a series of theses (Barber, 1995; Brothers, 2006; Heinze, 2001; Manthorp, 1995; van Heteren, 1996) and peer-reviewed papers (Brothers *et al*., 2008; Buynevich, FitzGerald, and van Heteren, 2004; FitzGerald *et al*., 2000, 2002, 2005; Hein *et al*., 2014; Hill *et al*., 2004; Kelley and Anderson, 2000; Kelley *et al*., 2005; Kelley and Brothers, 2009; van Heteren *et al*., 1996), we established that sand moves in a net northerly direction in the bay. The Army, after performing physical (Bottin, Mize, and Demirbilek, 1995) and numerical (Woods Hole Group Environmental Laboratories, 2006) modeling agreed with our field measurements. The problem of Gaalen *et al.* (2016) here was relying on a non–peer-reviewed publication by the Army that is 60 years old. A simple glance at Google Scholar shows that nine of the first 10 papers on the subject of "longshore transport Saco Bay Maine" are by those listed above, and all disagree with the 1955 Army study, as do the more recent Corps publications.

Although we will not comment on the other locations cited in the van Gaalen, Tebbens, and Barton (2016) paper because we are not familiar with all of those locations, we remain skeptical about how many are accurate on the basis of the obvious misunderstanding of the sand dynamics of Saco Bay. Numerous references cited in the paper are non–peer-reviewed theses, technical reports, field guides, and Army Corps studies. Although these works may be accurate assessments, no objective, external reviewers ever had the opportunity to critique them.

Coupled with the problem of lack of peer reviewed work is that most of the references are dated. Clearly, there has been a reliance on studies from the 1970s and 1980s, and more recent research from 1990s and 21st century were


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missed. Almost 60% of the references are from the 1970s and 1980s, and more were published before 1970 than since 2000. Clearly our work from the 1990s and 21st century were missed; how many other recent papers were similarly ignored in favor of a paper from the past? We hope readers examine this paper to find how regions of their expertise were treated. van Gaalen, Tebbens, and Barton (2016) used dated and potentially erroneous work in an attempt "to provide a complete view of the longshore sediment transport from the northern border of Maine" (actually from southern Maine; see Kelley, Belknap, and Walsh [2015] for a paper on longshore transport on the northeastern-most beach in the United States) to the mouth of Tampa Bay, Florida. While broad trends in longshore transport on the east coast of the United States have been clearly recognized (see John Fisher's classic 1967 study), there are also many examples of longshore transport reversals owing to wave refraction around ebb tidal deltas.

To be fair to van Gaalen, Tebbens, and Barton (2016), they selected a daunting task for a Master's degree student to accomplish, and much of the paper may be correct, but for newcomers to the field like the undergraduate we worked with, there is a presumption of accuracy with the most recent peer-reviewed papers. To better accomplish this task, the authors would have been wise to consult with local experts or some of the existing books that describe regions of the United States in detail, like Orrin Pilkey's Living with the Shore series by Duke University Press (*e.g.*, Kelley, Kelley, and Pilkey, 1989), that are locally authored within each state. Consultation of newer books by Miles Hayes and Jacqueline Michel (*e.g.*, Hayes and Michel, 2013) would also be encouraged.

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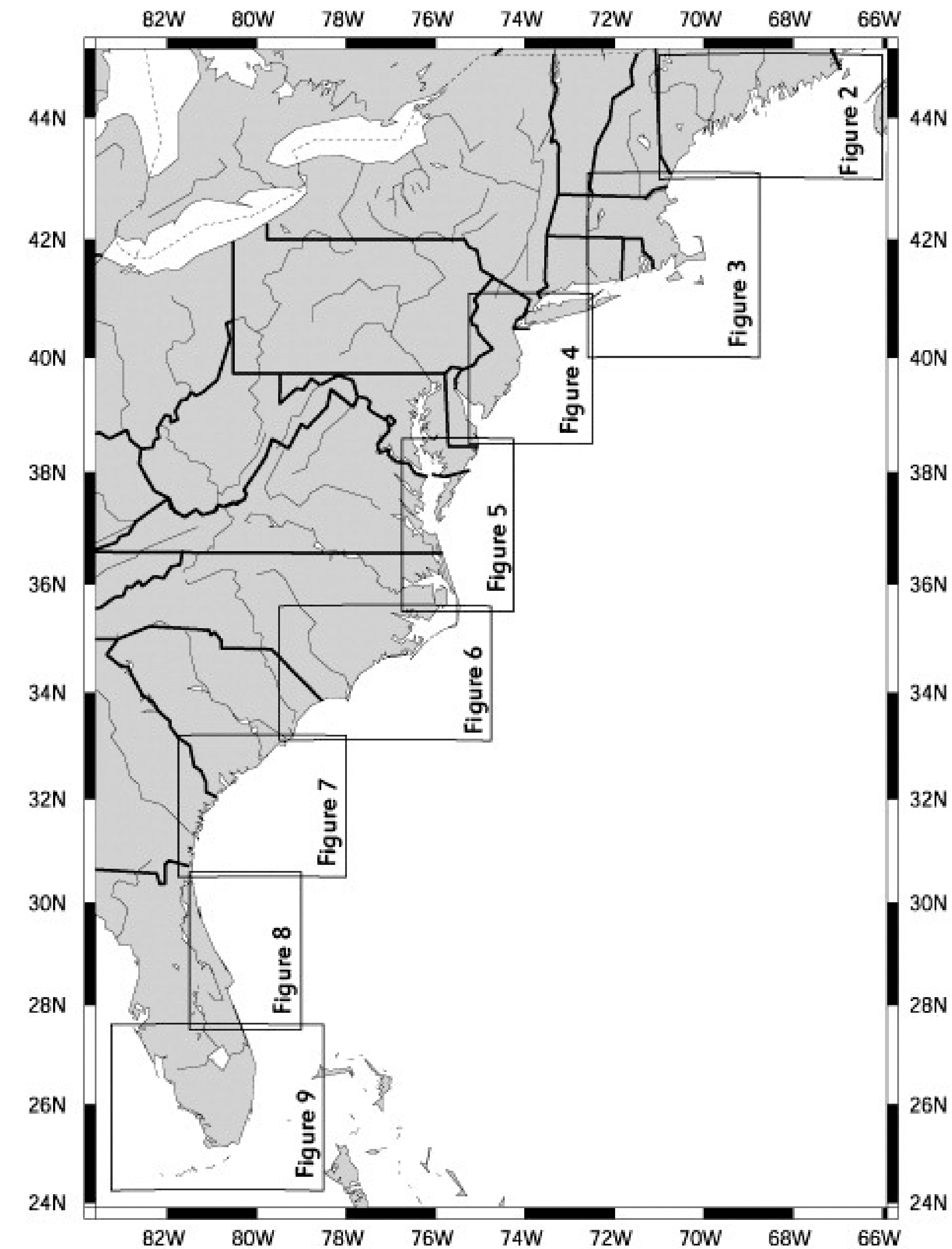

# REPLY

# Reply to: Kelly, J.T. and FitzGerald, D.M., 2017. Discussion of: van Gaalen, J.F.; Tebbens, S.F., and Barton, C.C., 2016. Longshore Sediment Transport Directions and Rates from Northern Maine to Tampa Bay, Florida: Literature Compilation and Interpretation. *Journal of Coastal Research*, 32(6), 1277–1301.

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We thank Kelley and Fitzgerald for their interest in our compilation paper (van Gaalen, Tebbens, and Barton, 2016). We regret that we missed the most recent studies related to the approximately 16-km section of coast of Saco Bay where we plotted a direction for sediment transport that is incorrect. We may have missed other studies along the approximately 4000-km of coast in our compilation, especially smaller scale features. To our knowledge, this is the first compilation of the direction and magnitude of sediment transport for the U.S. Atlantic and a small portion of the Gulf of Mexico coasts. Including erroneous information was not our intention. Extensive effort was made to be accurate and inclusive.

It is clear in Kelley and Brothers (2009) that Kelley and others have a history of unsatisfactory interactions with the U.S. Army Corps of Engineers (USACE) concerning Saco Bay. However, that does not justify the broad-brush criticism of our paper or all of the studies performed by the USACE. Kelley and Fitzgerald state they are "skeptical" of our work for locations with which they are "not familiar." This is an unjustifiable statement. Kelley and Fitzgerald also criticize the lack of inclusion of their work on the "northernmost beach in the United States" (Kelley, Belknap, and Walsh, 2015). This book chapter was published after our article was submitted to JCR and months after we completed our literature search, and therefore was not included. Additional papers in the future will likely also change the magnitudes and directions of transport reported.

Kelley and Fitzgerald question our choice of references. They suggest we should have consulted "some of the existing books that describe regions of the United States in detail." We did include the regional resources *Geology of Holocene Barrier Island Systems* by Skip Davis (1994) and *Beach Processes and Sedimentation* by Komar (1998). Kelley and Fitzgerald state we would have been "wise to consult with local experts or some of the existing books . . . like Orrin Pilkey's *Living with the Shore series*," such as the Maine volume (Kelley, Kelley, and Pilkey, 1989). Our paper is a compilation of the published literature; contacting local researchers was beyond the scope of our paper. Pilkey's series, while valuable, does not present the direction and magnitude of sediment transport. For present day Saco Bay, the Maine volume (Kelley, Kelley, and Pilkey, 1989) states "it is suspected by most geologists that the sand traveled north along the beach." There is no in-text reference and there is no mention of present day sediment transport magnitudes. A "suspected" transport direction does not meet the research threshold for inclusion in our compilation. Finally, Kelley and Fitzgerald suggest we should have included a reference to

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Fisher (1968). This reference is to a research abstract for the 1967 Annual Geological Society of America meeting and does not mention sediment transport magnitudes or directions.

Kelley and Fitzgerald question the use of USACE work and favor journal articles. A considerable effort was made in this compilation to go to original sources which are often USACE reports. Many research journal articles and books reference the USACE reports, including Kelley, Kelley, and Pilkey (1989). Indeed, Kelley, Kelley, and Pilkey (1989) reference Szuwalski and Wagner (1984) and Peck (1985a,b), which are themselves compilations of publications by the USACE and include our same USACE references.

In most regions, we cite a combination of reports and journal articles. Examples include: the Carolina coast, which cited FitzGerald, Fico, and Hayes (1979) from an American Society of Civil Engineers (ASCE) publication along with the research paper of Ashton, Murray, and Arnoult (2001); the Virginia coast which cited a Coastal Engineering Research Center (CERC) report (Anders and Hansen, 1990) and the journal article of Belknap and Kraft (1985); the Outer Banks which cited a technical report (Langfelder, Stafford, and Amein, 1968) and the journal article of Fenster and Dolan (1993); and New Jersey which cited a technical memorandum (Fairchild, 1966) and the research papers of Psuty (1983) and Ashley, Halsey, and Buteux (1986).

USACE reports have a reputation among some academics that they are not peer reviewed. This is not correct. The current policy of the USACE is for all reports to undergo external and internal review before publication. From 1902 to 1992, per the Navigation and Navigable Waters Act of 1902, an independent USACE Board of Rivers and Harbors composed of seven engineer officers was responsible for reviewing USACE reports and projects. The Beach Erosion Board was then folded into the Board of Rivers and Harbors in 1963, per the amended Navigation and Navigable Waters Act of 1962. The USACE reports used in our compilation (1947–92) were reviewed by engineers independent of the projects. The Water Resources Development Act of 1992 replaced the Board with an external peer review process.

While every effort was made to make this compilation complete and accurate, there are likely additional studies that we missed that would enhance the work. We welcome feedback from researchers who find sites where the compilation is missing supporting or contradictory work. JCR is open to publishing an addendum to include revisions.

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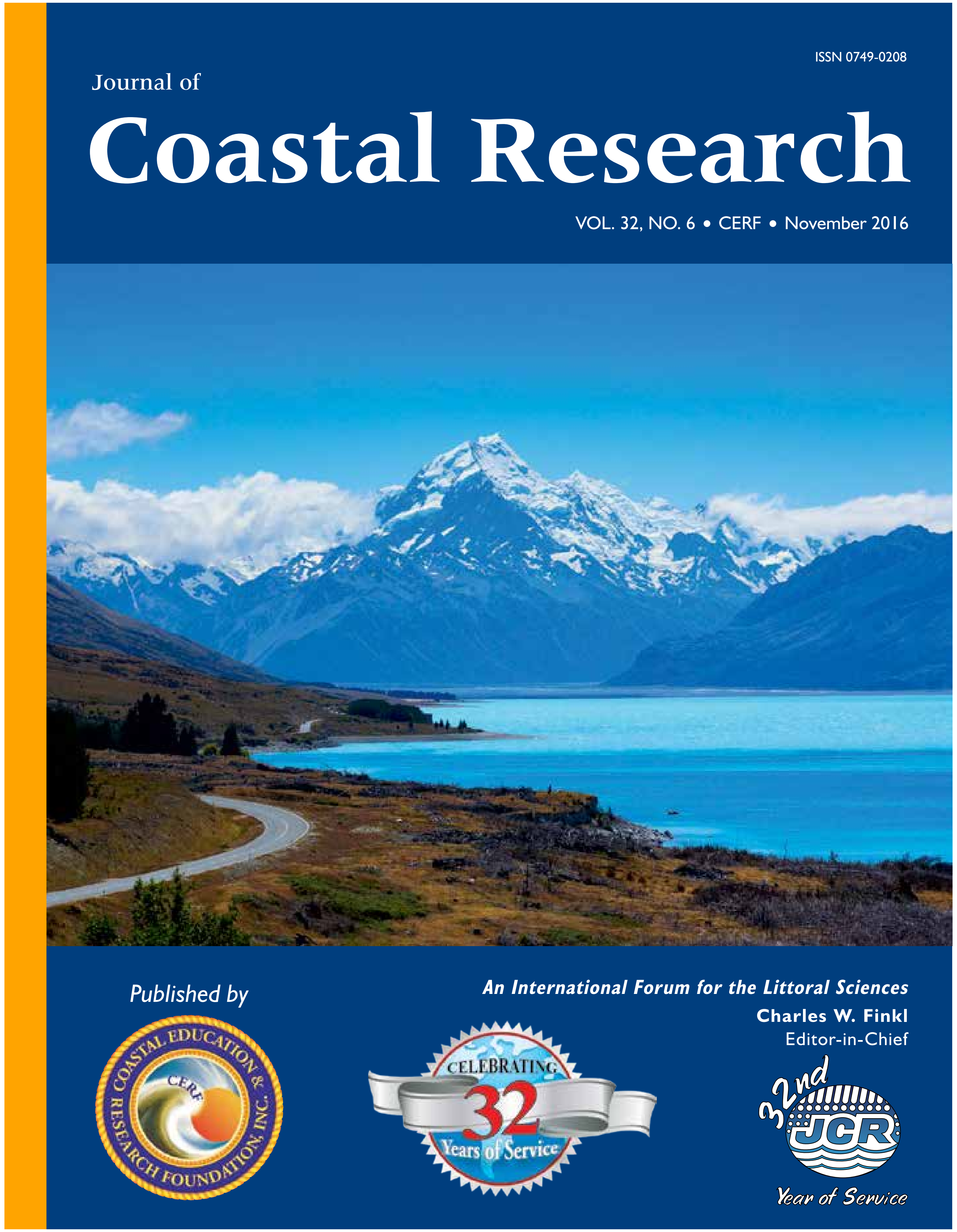
**Please find the original van Gaalen, Tebbens, and Barton (2016) article in JCR 32(6) at: http://www.jcronline.org/doi/abs/10.2112/JCOASTRES-D-15-00002.1**



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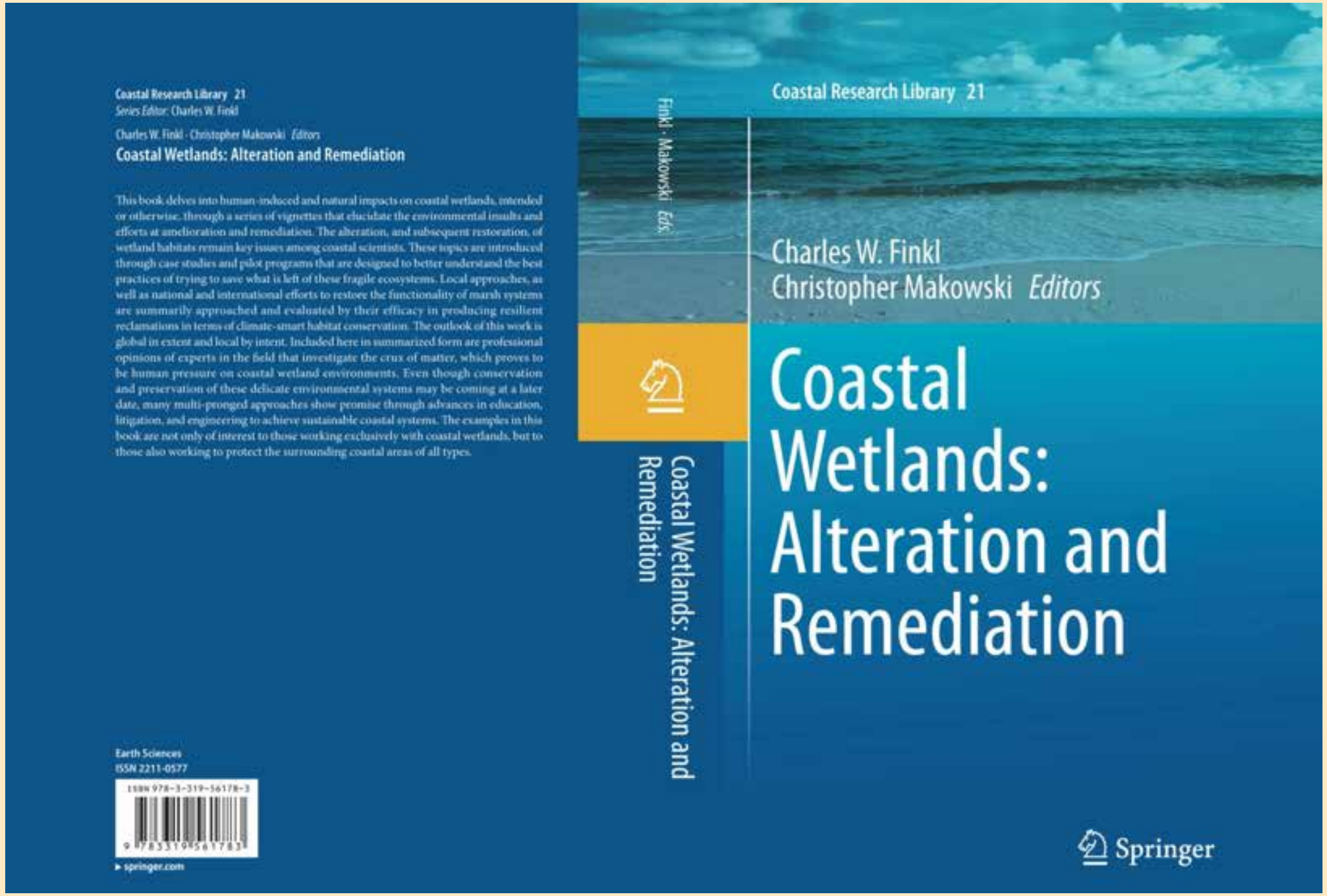


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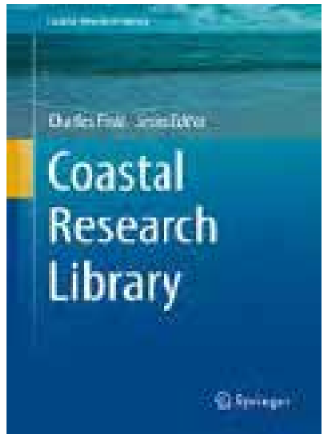


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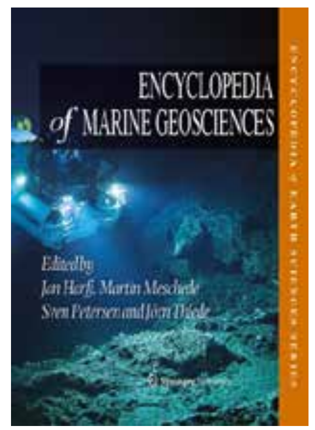


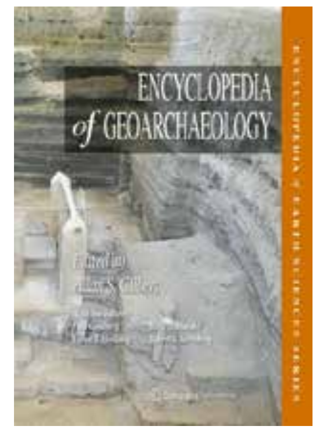


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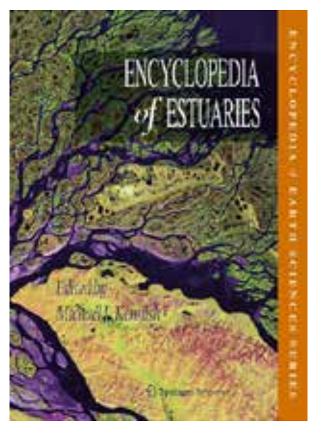


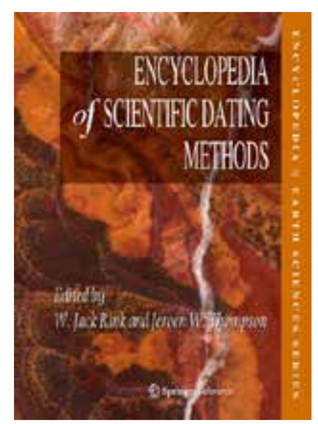


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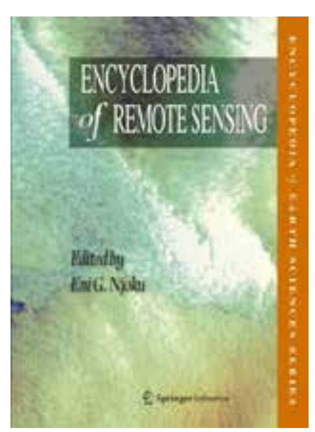


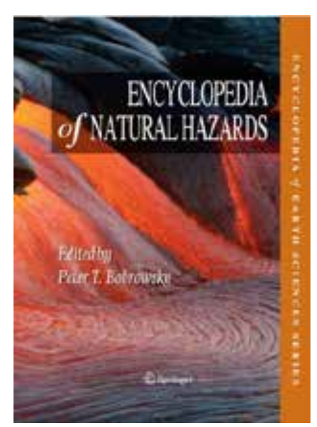


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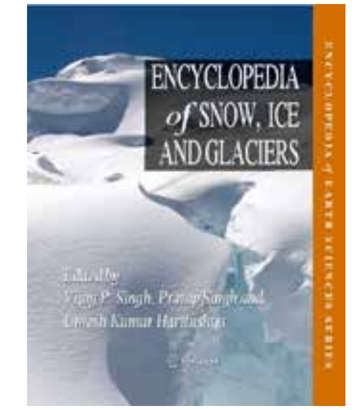


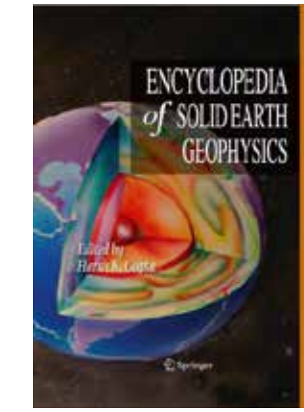


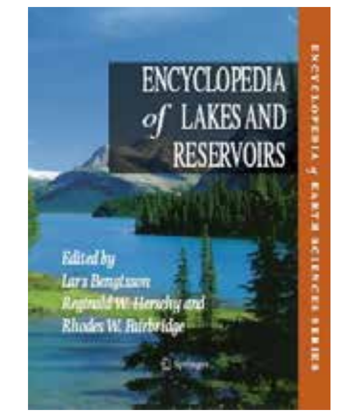


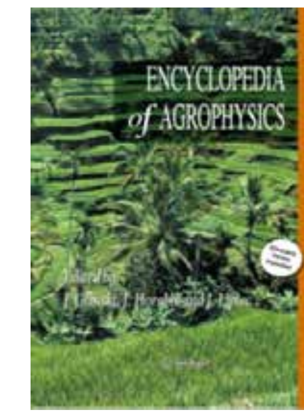


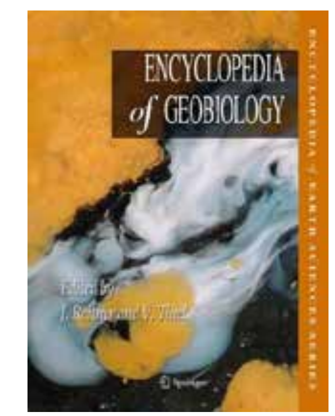


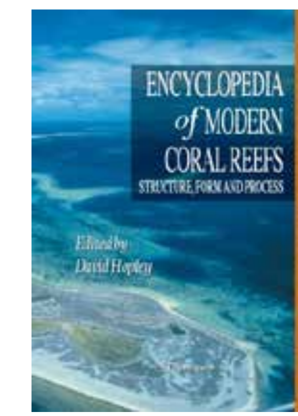


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# The Threat of a Nonnative, Invasive Apple Snail to Oligohaline Marshes along the Northern Gulf of Mexico

# The Threat of a Nonnative, Invasive Apple Snail to Oligohaline Marshes along the Northern Gulf of Mexico

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## ABSTRACT

Aquatic invasive species continue to be a persistent ecological problem. Management of these species requires understanding of their impact and the conditions favorable for their occurrence. *Pomacea maculata* is an invasive, nonnative freshwater apple snail threatening wetlands through substantial herbivory. Recent detection of *P. maculata* in coastal Alabama has raised concerns regarding the susceptibility of estuarine marshes in Mobile Bay and the northern Gulf of Mexico. To evaluate this threat, mesocosms were created to examine snail response to the combined effects of salinity and plant species common to estuaries throughout the region. Over a 5-week period, snails in brackish-water mesocosms (~10 parts per thousand [ppt], with *Juncus roemerianus* or *Cladium jamaicense*) became dormant and neither fed nor reproduced. Snails in freshwater mesocosms (<1 ppt, with *Alternanthera philoxeroides* or *Sagittaria lancifolia*) were active and exhibited herbivory, whereas snails in mixed salinity (~5 ppt, with *Typha angustifolia* and *Scirpus validus*) exhibited some activity but minimal herbivory. In follow-up studies examining salinity and plant species individually, snails fed on palatable leaves in only freshwater and mixed salinity conditions. Further, snails in freshwater did not consume measureable amounts of *S. validus, T. angustifolia*, *J. roemerianus*, and *C. jamaicense*, suggesting that plant palatability of common estuarine plants may also restrict herbivory. From these results, managers are cautioned that estuarine marshes with low to mixed salinities and colonized by palatable plants may be susceptible to invasion by *P. maculata*.

**ADDITIONAL INDEX WORDS**: Pomacea maculata, *tidal marshes, salinity, herbivory.*

## INTRODUCTION

Invasive species (species whose introduction can lead to economic or environmental harm or harm to human health; Williams and Meffe, 1998) pose a serious threat to global diversity as they may reduce biodiversity, alter community structure, and change ecosystem processes (Carlsson, Brönmark, and Hansson, 2004; Qui and Kwong, 2009). Invasive species may also transmit disease and overconsume resources in an ecosystem (Crowl *et al.*, 2008; Pimentel, Zuniga, and Morrison, 2005). In the United States, over 50,000 nonnative species have been introduced, leading to economic costs of approximately $120 billion/y (Pimentel, Zuniga, and Morrison, 2005). It has been estimated that competition with or predation by nonnative species has caused about half of the threatened or endangered native species in the United States to be at risk (Morisson and Hay, 2010; Wilcove *et al.*, 1998). The combination of native species loss and invasive species additions can alter various ecosystem functions, which may result in the loss of ecologically and economically valuable resources (Carlsson, Brönmark, and Hansson, 2004).

Wetlands include some of the world's most productive environments and are often susceptible to the influx of invasive species (Burlakova *et al.*, 2009; Zedler and Kercher, 2005). Tidal wetlands along the Gulf of Mexico are particularly under threat from an array of stressors related to surrounding land use and

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climate change (Kearney and Turner, 2015). A provider of both ecological services and economic benefits, coastal wetlands maintain water quality, protect inland areas from storms, and provide areas for recreation and tourism (Mitsch *et al.*, 2009). Aquatic plants are critical to these services as they contribute to ecosystem productivity and provide important structure and habitat (Cronk and Fennessy, 2001). Alterations in herbivore species assemblages due to the introduction of species can increase consumption, change plant community structure, and ultimately disrupt the ability of wetlands to provide ecological services (Carlsson, Brönmark, and Hansson, 2004).

*Pomacea maculata* (formerly known as *P. insularum*; Hayes *et al.*, 2012; Figure 1) are large freshwater apple snails native to South America. They are part of the *P. canaliculata* group within the Ampullariidae family that includes other concho-logically similar species including *P. canaliculata*, another highly invasive and destructive species (Hayes *et al.*, 2012). Introduced to the United States as early as the 1990s, *P. maculata* has become invasive and spread from Texas and Florida to seven southeastern states (Byers *et al.*, 2013; Rawlings *et al.*, 2007). As generalists, apple snails consume a wide range of submerged and emergent plants (Burks, Hensley, and Kyle, 2011; Burlakova *et al.*, 2009). These snails can change vegetation assemblages to the extent that macrophyte-dominated communities are transformed into phytoplankton-dominated communities (Carlsson, Brönmark, and Hansson, 2004), leading to numerous ecological and economic impacts (Byers *et al.*, 2013; Carlsson, Brönmark, and Hansson, 2004). Apple snails can also spread algal toxins, which bioaccumulate in their bodies and threaten local food webs (Berry and Lind, 2010; Robertson, 2012; Byers *et al.*, 2013). Robertson (2012) found that *P. maculata* can spread a neurotoxin associated with avian vacuolar myelinopathy, which is often lethal to birds, including avian apple snail predators such as the endangered snail kite (*Rostrhamus sociabilis plumbeus*).

The spread of *P. maculata* is a recent concern in the Mobile Bay area due to a fast-growing snail population in the city of Mobile, Alabama (Martin, Bayha, and Valentine, 2012). Adjacent to the city of Mobile, the Mobile–Tensaw Delta is the fourth largest estuary in the United States and a substantial area approximately 110,000 ha in size and containing more than 50 rare plants and animals (Handley *et al.*, 2011; Figure 2). The Mobile–Tensaw Delta is a river-dominated estuary populated by numerous plant species that reflect varied salinities that occur over time and space. Surface-water salinities in the lower Mobile–Tensaw Delta are affected largely by freshwater flows and range from <0.5 parts per thousand (ppt) during high flows to 5–10 ppt during low flows (Orlando *et al.*, 1993). As a result, estuarine marshes that occupy the lower delta normally represent a range of plant communities adapted to conditions ranging from brackish to freshwater. Wetland decline in Mobile Bay has been historically problematic because of past silviculture, industry, navigation, and surrounding urban development (Mobile Bay NEP, 2008).

In Mobile, a population of *P. maculata* was detected in 2008 along Three-Mile Creek, which drains into Mobile Bay near the lower reaches of the Mobile–Tensaw River delta. A second population was detected within a subdivision in Spanish Fort on the opposite side of the bay but also within proximity of the delta (Armstrong, *personal communication*; Martin and Valentine, 2014). Because of the proximity of these populations to the Mobile–Tensaw River delta, there continues to be questions about the threat *P. maculata* poses to the herbaceous wetlands in the delta. These snails, along with other species in the *Pomacea* genus, are typically associated with freshwater habitats (Fang *et al.*, 2010). However, *P. maculata* can tolerate salinities up to 6.8% in holding tanks (Ramakrishnan, 2007). Additionally, Martin and Valentine (2014) documented that *P. maculata* eggs and hatchlings responded negatively to increasing salinities up to 15 ppt; however, high salinities did not result in complete mortality. It is uncertain, though, how tolerant adult snails are to low salinity (oligohaline, <10 ppt) conditions in estuary ecosystems. Plant species palatability (emergent and submergent species) combined with snail salinity tolerance may be key factors that ultimately determine if and where these snails could eventually populate the delta.

Knowledge about salinity tolerance, plant species preference, and reproduction by *P. maculata* is needed to reduce further apple snail spread. Although other studies have focused on feeding rates of *P. maculata* (Boland *et al.*, 2008; Burks *et al.*, 2011), none of these studies has accounted for salinity to estimate how the combination of these factors may affect apple snails in brackish waters. To better understand the environmental conditions in which invasive *P. maculata* can survive and spread in Mobile Bay and other estuaries, the objective of

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this study was to examine the combined and individual influence of plant species and salinity on apple snail herbivory. Six common wetland macrophytes of the Mobile–Tensaw River delta were used in single food-source experiments with fresh, mixed, and brackish-water regimes. A series of follow-up studies was conducted to isolate the influence of plant species palatability and salinity on snail consumption to better understand mesocosm results. It was predicted that all habitats would support snails to some extent, but snail consumption would be greatest in freshwater environments (<1 ppt) and significantly less in mixed (5 ppt) or brackish (10 ppt) environments.

**Figure 1. Close-up photograph of *Pomacea maculata* used in this study (photo credit: H. Walsh, Mobile Baykeeper).**


*Continued on Next Page*

**Figure 2. Photograph of marshes located along the lower Mobile–Tensaw Delta in Mobile Bay near Mobile, Alabama (photo credit: K. Hicks).**

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The International Conference "New Technologies, Hazards and Geoarchaeology" will take place in the historic and beautiful city of Athens on the 3rd of November 2017 and will be hosted by the Department of Physical Geography and Climatology of the National an Kapodistrian University of Athens. The conference is organised on the framework of the Erasmus+ Project "McAgenda", with the collaboration and co-organization of the Hellenic Committee for Geomorphology and Environment.

The main aim of the conference is to disseminate the results of the McAgenda Erasmus+ Program. Other important objectives of the Conference are to encourage collaboration between scientists from different countries on the theme "New Technologies, Hazards and Geoarchaeology", and also give the chance to new scientists and postgraduate students to present their work on this scientific field.

The structure of the conference will consist of plenary sessions followed by extensive poster sessions.

We are looking forward to welcome you in Athens during our Conference!

Niki Evelpidou
Associate Professor
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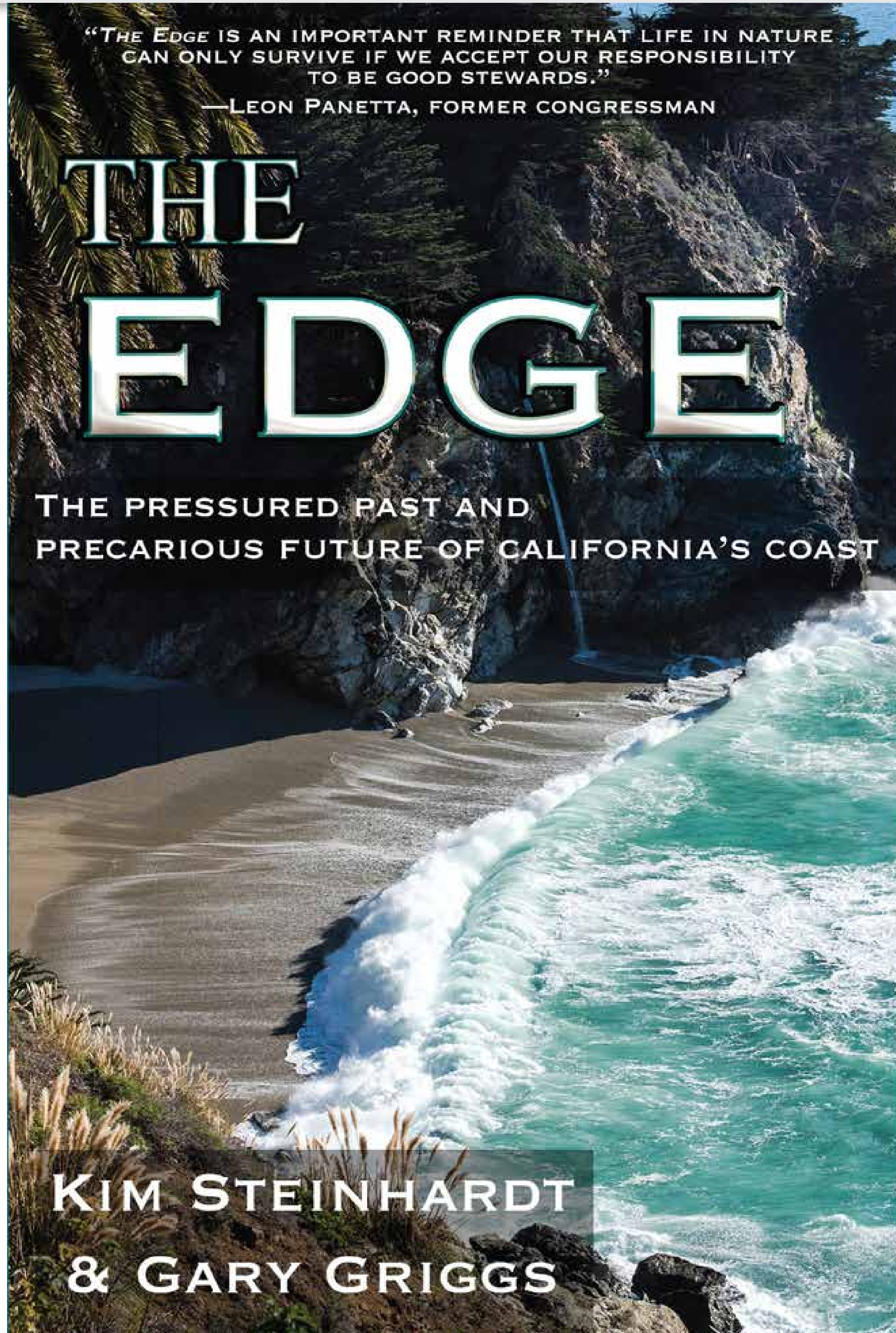


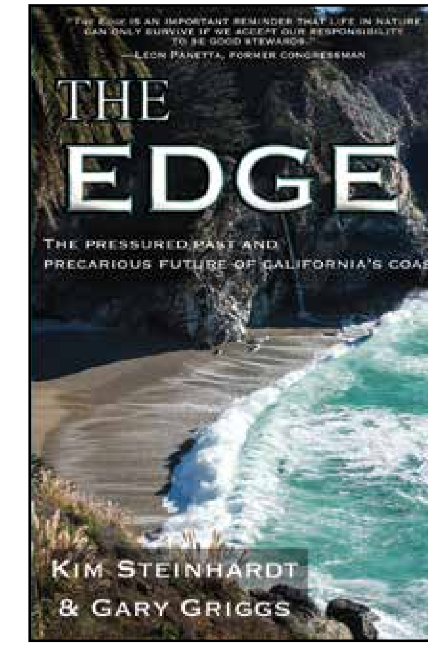

# Advance Title Information

## The Edge

### The Pressured Past and Precarious Future of California's Coast

### by Kim Steinhardt and Gary Griggs

### Publication Date: October 1, 2017

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The Pacific coast is the most iconic region of California and one of the most fascinating and rapidly changing places in the world. Densely populated, urbanized and industrialized — and also home to complex, fragile ecosystems — the coast is the place where humanity and nature coexist in a precarious balance that is never perfectly stable.

***The Edge: The Pressured Past and Precarious Future of California's Coast*** is a dramatic snapshot of the California coast's past, present and probable future in a time of climate change and expanding human activity. Written by two marine experts who grew up on the coast, ***The Edge*** is both a celebration of the coast's natural and cultural uniqueness and a warning of the many complex changes that threaten that uniqueness.

As ocean levels rise, coastal communities are starting to erode, and entire neighborhoods have been lost to the sea. Coastal ecosystems and wildlife that were already stressed by human settlement now face new dangers. The competing impacts of climate change, housing and commercial growth, commercial fisheries, oil drilling and production, and environmental advocacy all combine to define the future of the region.

***The Edge*** examines the current state of the coast's natural and social environments, gives the historical causes for the coast's present endangerment and offers informed projections on possible scenarios of the coast's future. A masterful and sweeping synthesis of environmental and social science, ***The Edge*** presents a comprehensive portrait of the history, people, communities, industries, ecology and wildlife of the California coast.

**Audience:** Readers interested in environmental issues, marine wildlife, climate change and California history.

**About the Authors:** A widely recognized marine wildlife photographer, former administrative law judge, and a long-time conservation advocate, **Kim Steinhardt** delivers popular lectures and photographic programs on coastal conservation and ocean stewardship issues for aquariums and marine centers, universities, state parks and other audiences. **Gary Griggs** has written or co-authored nine books about the coast and coastal issues both in California and globally. As a Distinguished Professor of Earth and Planetary Sciences at the University of California at Santa Cruz, he is known for his expertise in oceanography and coastal geology. He serves as the director of the Institute of Marine Sciences at UC Santa Cruz.

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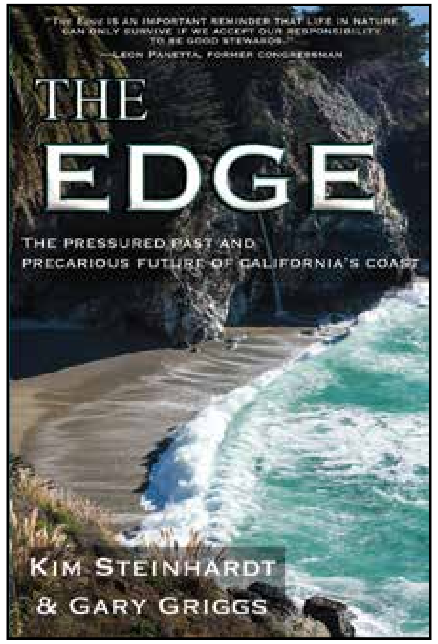
# Blending science, history and ecology, *The Edge* presents a dramatic portrait of California's breathtaking and endangered coastline

## "*The Edge* is an important reminder that life in nature can only survive if we accept our responsibility to be good stewards." —from the Foreword by former congressman Leon Panetta




The Pacific coast is the most iconic region of California and one of the most fascinating and rapidly changing places in the world. Densely populated, urbanized and industrialized — and also home to complex, fragile ecosystems — the coast is the place where humanity and nature coexist in a precarious balance that is never perfectly stable.

Two marine experts who grew up on the coast present a dramatic snapshot of a region undergoing massive change in ***The Edge: The Pressured Past and Precarious Future of the California Coast*** (Craven Street Books, October 2017).

Written in clear language for the layperson, ***The Edge*** presents an accessible survey of a huge range of topics, from sea-level rise to the history of offshore oil drilling to the health of the sea otter population. ***The Edge*** examines the current state of the coast's natural and social environments, gives the historical causes for the coast's present endangerment and offers informed projections on possible scenarios of the coast's future.

A fascinating blend of science, history, sociology and ecology, ***The Edge*** is both a celebration of the coast's natural and cultural uniqueness and a warning of the many complex changes that threaten that uniqueness.

In this era of rapid climate change, the threats to the California coast are serious. As glaciers melt and ocean levels rise, coastal communities are starting to erode, and entire neighborhoods have been lost to the sea. Coastal

–more–

ecosystems and wildlife that were already stressed by human settlement now face new dangers.

But the coast has its heroes and defenders as well. ***The Edge*** presents exciting profiles of the people, organizations and programs that are working to maintain the coast's equilibrium, biodiversity and capacity to support wildlife. Co-authors Kim Steinhardt and Gary Griggs give their personal stories of how their coastal childhoods and personal love of the ocean fostered their commitments to environmental research and activism. Each chapter includes testimonies from ordinary Californians on what the coast means to them and why they think it is worth protecting.

Among the topics covered in ***The Edge*** are:

—A migrating edge: The line where the land meets the sea is never static, and now climate change is steadily eroding the California coastline. ***The Edge*** gives a lucid explanation of the science of sea-level rise, how rising waters are reshaping the California coastline, and how nature is whittling away at coastal land, transforming the California real estate market.

—Oil on the edge: One of the most contentious issues on the coast is offshore oil drilling. ***The Edge*** outlines the science of petroleum formation, the history of oil industry in California, and how oil drilling has repeatedly challenged and galvanized the environmental movement.

—Sea otter survival: Cute, playful and photogenic, sea otters have long been the poster child for coastal wildlife preservation. ***The Edge*** profiles the sea otters' pivotal role in the history of California, their comeback from the verge of extinction, and the ongoing threats this remarkably resilient species still faces.

—Additionally, ***The Edge*** covers the history of human settlement in California, the successes and failures of the environmental movement, detailed accounts of wildlife and human activity, and more.

A masterful and sweeping synthesis of environmental and social science, ***The Edge*** presents a comprehensive portrait of the history, peoples, communities, industries, ecology and wildlife of the coast.

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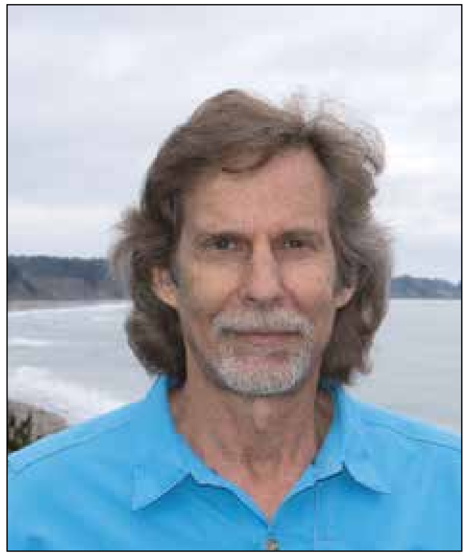
# About Kim Steinhardt

## Co-Author of *The Edge*

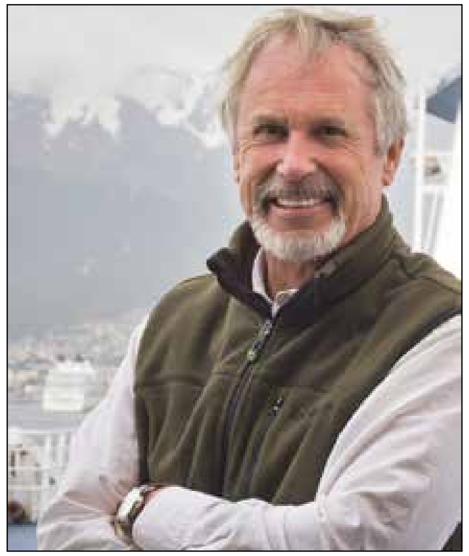


**Kim Steinhardt** delivers popular lectures and photographic programs exploring the universe of sea otters and coastal conservation for aquariums and marine centers, universities, state parks, and other audiences. He has been recognized for his award winning marine wildlife photography and is currently working with National Geographic on publication of a book of his sea otter images and coastal storytelling. He has also served as an advisor regarding sea otters for the NatGeo Kids Explore My World series and, for the last five years, has written a newsletter column about marine wildlife and the ocean. As a long-time conservationist drawing on his former service as a California state administrative law judge, litigator and public interest advocate, he helps translate ocean conservation concerns to the public to build support for citizen action and legislative policymaking.



# About Gary Griggs

## Co-Author of *The Edge*



**Gary Griggs** has written or co-authored nine books about the coast and coastal issues both in California and globally. As a Distinguished Professor of Earth and Planetary Sciences at the University of California at Santa Cruz, he is known for his expertise in oceanography and coastal geology. He is a frequent contact for news media on questions of climate change, sea-level rise, coastal erosion and other related issues. He has written a popular biweekly newspaper column ("Our Ocean Backyard") for nine years, and is in high demand for talks throughout California. He serves as the director of the Institute of Marine Sciences at the University of California at Santa Cruz, which includes the Long Marine Laboratory and the Seymour Marine Discovery Center, a popular educational destination for tens of thousands of visitors each year.

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For more information on *The Edge* (Craven Street Books, October 2017) or to arrange an interview with co-authors **Kim Steinhardt** and **Gary Griggs,** please contact Jaguar Bennett at Craven Street Books, (800) 345-4447,Publicity@QuillDriverBooks.com.


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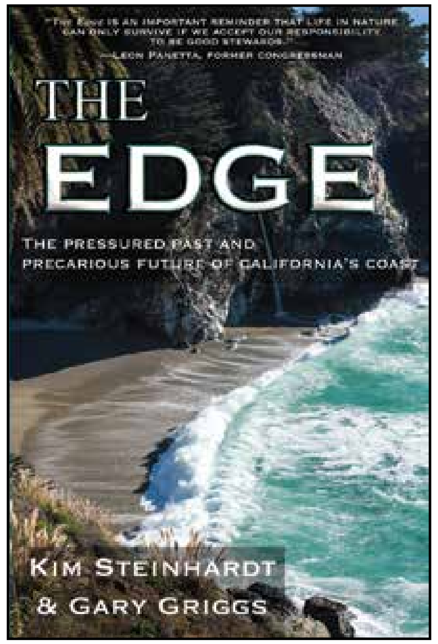
# Advance praise for *The Edge*




"***The Edge*** is an important reminder that life in nature can only survive if we the living accept our responsibility to be good stewards. The legacy of the beauty of our coastline that was passed on to us must be protected for future generations. ***The Edge*** is a comprehensive portrait of the Pacific coast and why we are responsible for its future."
**—**from the Foreword by **Leon Panetta**, former congressman and chair of the Pew Oceans Commission

"This book captures the magic of the coast. It has an intimate blend of nature, science, politics, policy, culture, history, and adventure, and there is a well-informed urgency that gives readers more than just the information and heightened awareness they need to bring about real change to our ocean policies and practices: It is a personal call to action. Dive in!"
**—Sam Farr**, former congressman and ocean advocate

"Steinhardt and Griggs have created a delightful and insightful tour of California's coastal edge, past, present, and future. They do a masterful job of weaving together the interconnections of the changing natural world over different time scales with the changing societal landscape and human interventions to modify the coastal edge as population grew and societal priorities changed. Their discussions of how those interventions were shaped by clashes between conservationists and those with strong economic motivations are infused with some of their own values. In combination with the first two chapters that introduce the reader to the backgrounds of the authors, these personal views enhance the narrative. Their stories of the boom and bust cycles of many of our fisheries and of populations of marine mammals have many lessons for us today, not only for resource managers, but for everyone concerned with human rights. I recommend this book to all who are interested in one of the most beautiful coasts in the world."
**—Jerry R. Schubel, Ph.D.**, President and CEO, Aquarium of the Pacific

"Kim Steinhardt and Gary Griggs each have had a long love affair with the California coast. You can see it in their personal stories, and how they worry about the long-term effects of human interaction between land and water. This is a must read for anyone who shares their love for the coast and concern for its future."
**—John Laird,** California Secretary for Natural Resources, and Chair of the California Ocean Protection Council

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For more information on ***The Edge*** (Craven Street Books, October 2017) or to arrange an interview with co-authors **Kim Steinhardt** and **Gary Griggs,** please contact Jaguar Bennett at Craven Street Books, (800) 345-4447,Publicity@QuillDriverBooks.com.



## INVITATION

It is with great pleasure that we invite you to the International Coastal Symposium (ICS2018), to be held from Sunday 13th – Friday 18th May 2018 at the Haeundae Grand Hotel, Haeundae Beach, Busan, Republic of Korea. The theme is 'Safe Coasts Beyond Climate Change and Coastal Development'. The International Coastal Symposium (ICS) is now in its 15th edition and this is the first time in Asia.

The Symposium is co-hosted by Korea Institute of Ocean Science & Technology (KIOST) and Korean Society of Coastal Disaster Prevention (KSCDP), under the auspices of the Coastal Education and Research Foundation (CERF) and the Journal of Coastal Research (JCR).

The ICS brings together delegates from all over the world to collaborate and discuss the most current coastal research studies and projects. The proceedings of the conference, published as peer-reviewed papers in the Journal of Coastal Research, represent an invaluable resource for coastal scientists, engineers and managers.

Dr. Jae-Seol Shim
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Prof. Insik Chun
Co-Chairman of ICS2018
Ph.D./PE/Professor
Coastal & Harbor Engineering/
Department of Civil Engineering/ Konkuk University
ischun@konkuk.ac.kr

## PROGRAM

| Date | May13 (Sun.) | May 14 (Mon.) | | May 15 (Tue.) | | May 16 (Wed.) | | May 17 (Thu.) | May 18 (Fri.) | May 19. (Sat) |
|---|---|---|---|---|---|---|---|---|---|---|
| Am. | | Opening Plenary, Keynote Speech | | Keynote Speech | | Keynote Speech | | Keynote Speech | Field Trip | Field Trip (Optional) |
| Pm. | | Session 1~5(6) | POSTER | Session 1~5(6) | POSTER | Session 1~5(6) | POSTER | Session 1~5(6) | | |
| | Welcome Reception | | | | | | | Conference Dinner | | |


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## CALL FOR ABSTRACTS

**Abstract submission system is opened from 1st March 2017.**

The ICS2016 Scientific Program Committee invites authors to submit an abstract for either an oral or poster presentation. The conference theme is ‘Safe Coasts beyond Climate change and Coastal development’.

### Abstract Guidelines

Please ensure you submit your abstract as a Word document. The abstract template is shown by .

**Themes**

Abstracts can be submitted from all areas of coastal science, from Geology to  Coastal hazards. The themes* are:

- Rivers and Estuaries
- Tidal inlets
- Dunes and Beaches and Coasts
- Coastal Biology and Ecology
- Coastal Geology
- Continental shelves and slopes
- Coral reefs
- Climate and Sea level change
- Coastline and Estuarine evolution
- Blue carbon
- Coastal hazards
- Hydrodynamics
- Coastal engineering
- Marine renewable energy
- Coastal management
- Managing the coasts of  Busan


## KEY DATES

- **1st Mar. 2017** — Call for abstract submission
- **30th June 2017** — Abstract submissions Close
- **1st Aug. 2017** — Authors advised of acceptance of abstracts
- **1st Aug.~ 31st Oct. 2017** — Paper submissions
- **1st~30th Nov. 2017** — Paper reviewed
- **31st Dec. 2017** — Final papers submitted
- **1st Aug. 2017~ 28th Feb. 2018** — Early bird registration

## REGISTRATION FEES

| Category | | USD | KRW |
|---|---|---|---|
| Early Bird Registration Until 28 February 2018 | Full Registration | 700 | 800,000 |
| | Student | 450 | 500,000 |
| Standard Registration From 1 March 2018 | Full Registration | 900 | 1,000,000 |
| | Student | 600 | 700,000 |
| Early Bird Registration | CERF Member (5% discount) | 665 | 750,000 |

All registration packages include

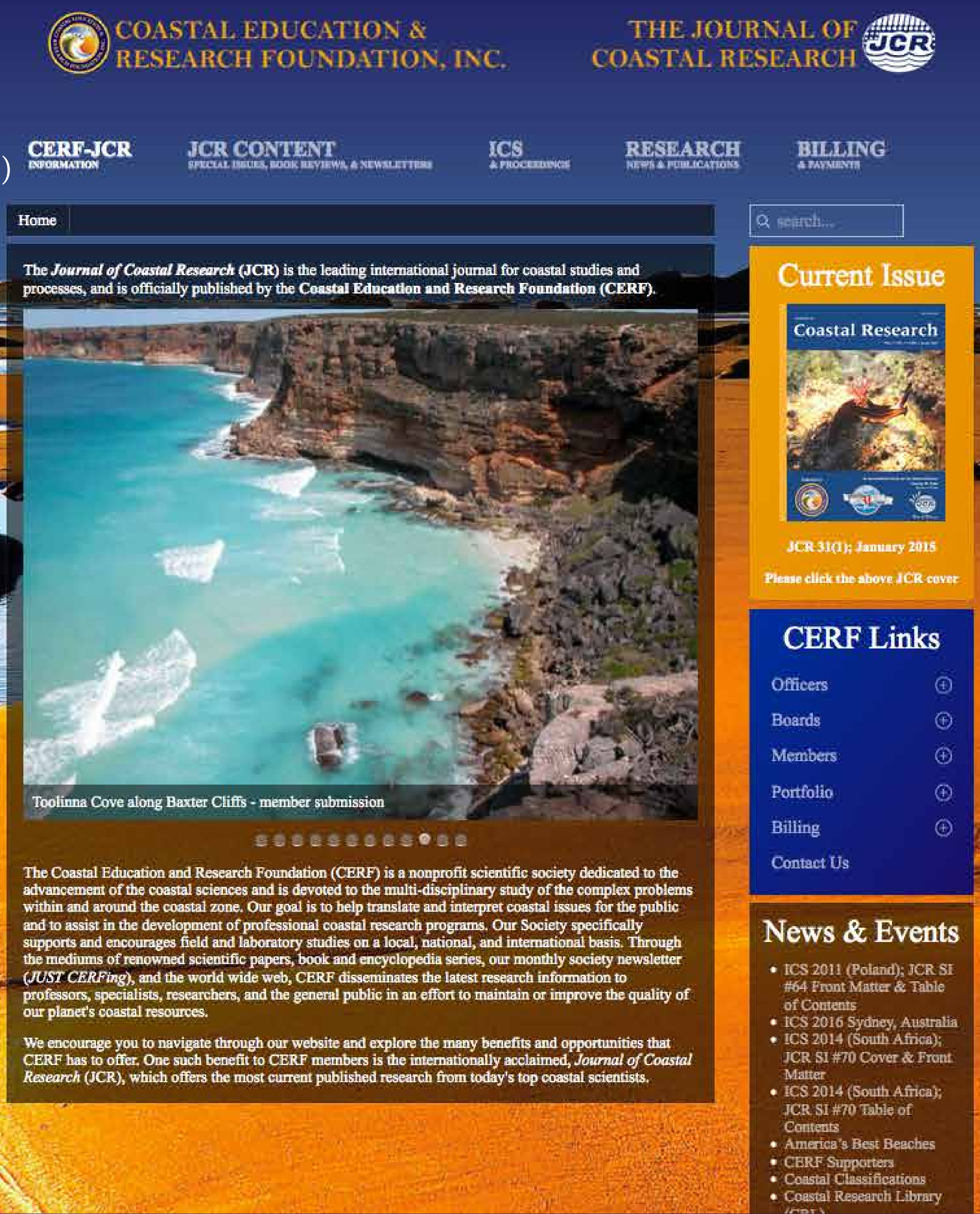
- Welcome Reception on Sunday 13 May
- Attendance at all conference sessions
- Conference Dinner on Thursday 17 May
- Choice of a number of full day field trips on Friday 18 May
- Arrival tea & coffee, morning tea, lunch and afternoon tea for the duration of the conference

## CONTACT

Ji - Hye Choi
Event Manager
ICS2018 Secretariat
GFC(Global Fairs & Conference)
Email: secretariat@ics2018.org
Phone: +82-2-6000-2502

Dr. Hak-Soo Lim
Secretary of ICS2018
Principal Research Scientist of KIOST, Korea
Email: hslim@kiost.ac.kr
Phone: +82-31-400-6334

Introducing the new official website of the Coastal Education and Research Foundation (CERF)




Please visit www.cerf-jcr.org or Google Search: cerf-jcr to navigate through all our great new features

# CERF-JCR Membership Options

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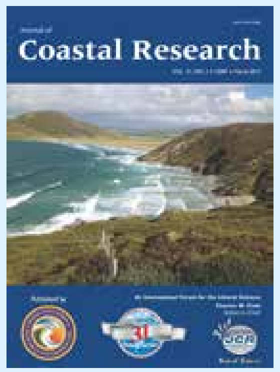


**Includes:**
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***2- and 3-year memberships can always add a JCR printed subscription (Please contact us at CERF@allenpress.com and mailing costs apply)**

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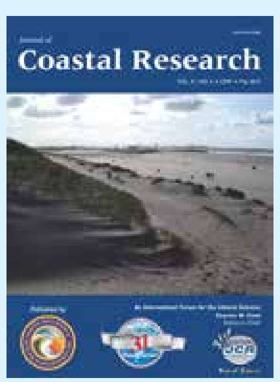


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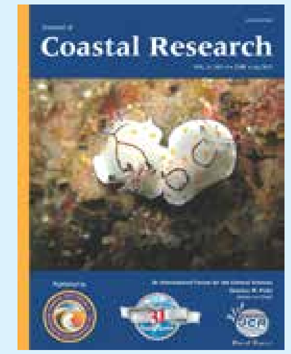


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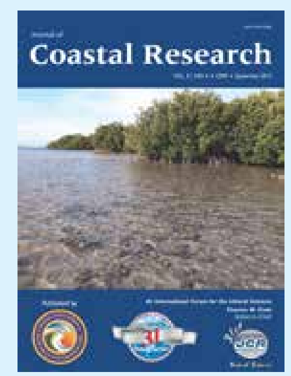


**Includes:**
- All the benefits of individual CERF membership
- Annual online and printed subscription to the JCR
- A full Fellow Member Profile webpage detailing your affiliation, research, and announcements on our internationally-viewed Foundation and JCR online websites http://www.cerf-jcr.org and http://www.JCRonline.org and in our society newsletter, *Just CERFing*
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- Official personalized CERF Fellow Member Certificate

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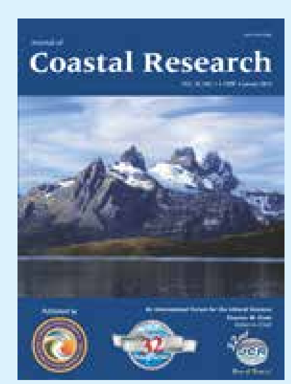


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- Continuous benefits of individual CERF membership
- Lifetime subscription to the online and printed versions of the JCR
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- Official personalized CERF Lifetime Member Certificate


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# CERF-JCR Membership Options

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- Notices and reduced registration fees for the International Coastal Symposium (ICS), the official meeting of CERF

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- 2 free JCR Archived Regular Issues or Special Issues
- CERF society monthly newsletter, *Just CERFing*
- Official personalized CERF Member Certificate
- Notices and reduced registration fees for the International Coastal Symposium (ICS), the official meeting of CERF
- Registration into our manuscript submission website
- Reduced fees for manuscript submission, publication, and color charges
- Ability to submit coastal photographs for the purpose of publication in the JCR
- Participation & sharing with a distinguished international group of scholars and scientists

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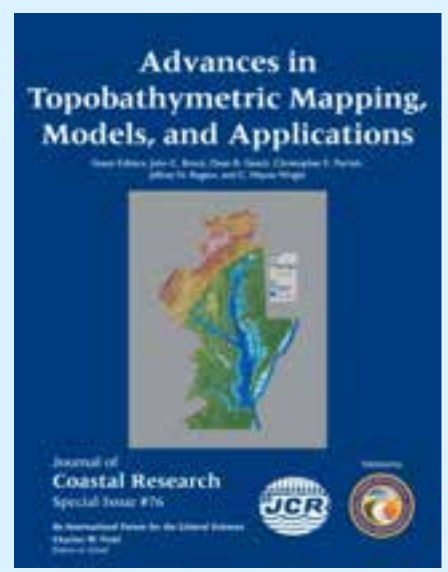
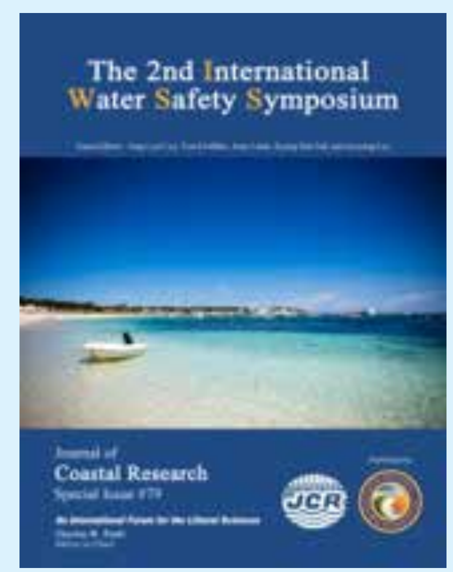
JCR 32(6)
December 2016


JCR 33(1)
January 2017

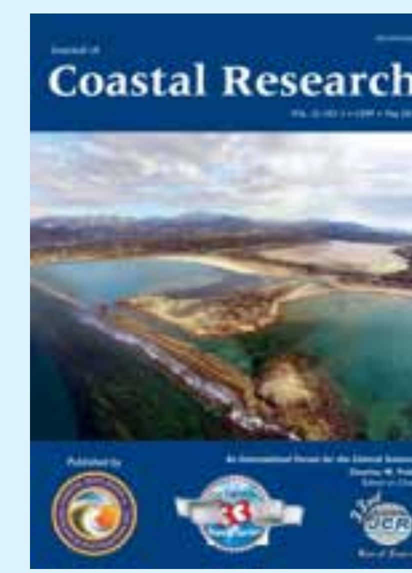



JCR Special Issue #76
Winter 2016




JCR Special Issue #79
Spring 2017


JCR 33(2)
March 2017

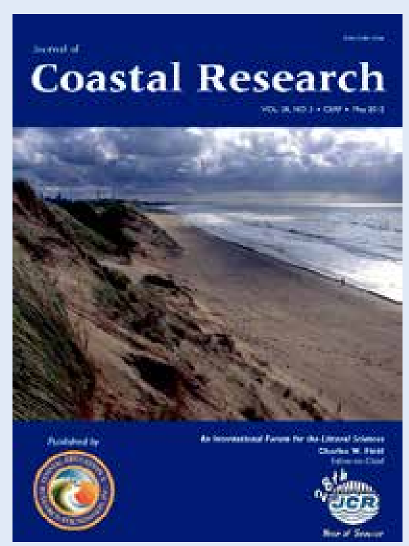



JCR 33(3)
May 2017

# Publish Your Coastal Photographs in the JCR!

As a CERF member, you have the unique opportunity to become a published photographer in our internationally renowned journal!

All possible submissions must depict some coastal or underwater/marine scene and must be high-quality (>300 dpi) image files in either a jpg, tiff, or gif format. In addition, a short caption must accompany the photograph. The caption should include the specific location of the photograph, the date taken, the geological or coastal significance, and your CERF member contact information (full name, title, phone, email, and CERF member number). Example captions can be found on the Gallery page of this website.




While most submissions will be selected for either the CERF website or inside the JCR, a chosen few will actually be selected to be the cover image of a JCR Issue! So dust off those cameras and submit your photos.

Submit your photo and information by email attachment to CMakowski@cerf-jcr.com

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# CERF Board of Directors (Trustees)

# *Journal of Coastal Research* (JCR) Editorial Board



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# CERF Lifetime Members

Dr. Charles Lemckert

Dr. Yong-Sik Cho

Dr. Ya-Ping Wang

Dr. Nicholas K. Coch

Dr. Hany Elwany

Dr. Björn Kjerfve

Dr. Wei Zhang

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# *A Special Acknowledgement To:*
# Associate Professor Dr. Charles Lemckert
## CERF Lifetime Member

We are proud to acknowledge Associate Professor Dr. Charles Lemckert as the Coastal Education & Research Foundation's first ever Lifetime Member. Dr. Lemckert has always showed great support for CERF and the JCR, and even served as the Chair and Organizer of the 9th International Coastal Symposium (ICS) at Griffith University (Queensland, Australia) in 2007. We are honored to have Dr. Lemckert as a Lifetime Member and warmly recognize his devotion to our coastal research society.

Associate Professor Lemckert has active research interests in the fields of physical limnology, coastal systems, environmental monitoring techniques, environmental fluid dynamics, coastal zone management and engineering education. Along with his postgraduate students and research partners he is undertaking research studies on water treatment pond design (for recycling purposes), the dynamics of drinking water reservoirs, the study of whale migration in South East Queensland Waters, end ocean mixing dynamics.

Selected Publications:

Ali, A.; **Lemckert, C.J**.; Zhang, H., and Dunn, R.J.K., 2014. Sediment dynamics of a very shallow subtropical estuarine lake. *Journal of Coastal Research*, 30(2), 351-361.

Dunn, R.J.K.; **Lemckert, C.J**.; Teasdale, P.R., and Welsh, D.T., 2013. Macroinfauna Dynamics and Sediment Parameters of a Subtropical Estuarine Lake—Coombabah Lake (Southern Moreton Bay, Australia). *Journal of Coastal Research*, 29(6A), 156-167.

Ali, A.; **Lemckert, C.J.**, and Dunn, R.J.K., 2010. Salt fluxes within a very shallow subtropical estuary. *Journal of Coastal Research*, 26(3), 436-443.

Brushett, B.A.; King, B., and **Lemckert, C.J**., 2011. Evaluation of met-ocean forecast data effectiveness for tracking drifters deployed during operational oil spill response in Australian waters. *In*: Furmańczyk, K.; Giza, A., and Terefenko, P. (eds.), Proceedings from the International Coastal Symposium (ICS) 2013 (Plymouth, United Kingdom). *Journal of Coastal Research,* Special Issue No. 64, pp. 991-994.

**Lemckert, C.J**.; Zier, J., and Gustafson, J., 2009. Tides in Torres Strait. *In*: da Silva, C.P. (ed.), Proceedings from the International Coastal Symposium (ICS) 2009 (Lisbon, Portugal). *Journal of Coastal Research*, Special Issue No. 56, pp. 524-528.

**For a complete list of Dr. Lemckert's publications or his contact information, please visit:**
**http://www.griffith.edu.au/engineering-information-technology/griffith-school-engineering/staff/associate-professor-charles-lemckert**


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# *A Special Acknowledgement To:*
# Professor Yong-Sik Cho
## CERF Lifetime Member

We are proud to acknowledge Professor Yong-Sik Cho as a Lifetime Member of the Coastal Education & Research Foundation. Professor Cho, Yong-Sik received his bachelors and masters degrees from Hanyang University in February 1981 and August 1988 respectively, and his Ph.D. from the School of Civil and Environmental Engineering of Cornell University in January, 1995. The title of the thesis is Numerical Simulations of Tsunami Propagation and Run-up (Advisor: Professor Philip L.-F. Liu).

He had continuously worked at Cornell University as a Post-Doctoral Associate after graduation. From March of 1997, he had been employed as an Assistant Professor at the Department of Civil and Environmental Engineering at Sejong University and then moved to Hanyang University in March, 2000. From February 2003 to January 2005, he had served as the Chair of the Department of Civil and Environmental Engineering at Hanyang University. Professor Cho has served as the Director of Innovative Global Construction Leader Education Center, a government enterprises sponsored by the Ministry of Education, Science and Technology, and the Chair of Graduate Studies of the Department of Civil and Environmental Engineering since 2006.

Professor Cho has published 52 journal papers in prominent international journals registered in Science Citation Index such as *Coastal Engineering*, the *Journal of Coastal Research*, the *Journal of Fluid Mechanics*, the *Journal of Hydraulic Research*, *Physics of Fluids*, the *Journal of Geophysical Research*, the *Journal of Engineering Mechanics*, *and Ocean Engineering*. He has also published 120 papers in domestic journals and about 360 proceedings in international and domestic conferences. Professor Cho has also registered eight patents.

**Selected Publications:**

Kim, Y.-C.; Choi, M., and **Cho, Y.-S**., 2012. Tsunami hazard area predicted by probability distribution tendency. *Journal of Coastal Research*, 29(5), 1027-1038.

**Cho, Y.-S**., 2012. Numerical study for spreading of a pollutant material in coastal environment. *Energy Sources*, Part A, 34(16), 1459-1470.

**Cho, Y.-S.**; Kim, T.-K.; Jeong, W.-C., and Ha, T.-M., 2012. Numerical simulation of oil spill in ocean. *Journal of Applied Mathematics*, 2012, 1-15.

**For a complete list of Professor Cho's publications or his contact information, please visit: http://civil.hanyang.ac.kr/coast/**

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## *A Special Acknowledgement To:*

# Professor Ya-Ping Wang

## CERF Lifetime Member

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Jiangsu Key Laboratory for Coast and Island Development
Department of Coastal Ocean Sciences
School of Geography and Oceanography
Nanjing University, China
Telephone: (+)86 25 3597308 (O)
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### DEGREES AND DIPLOMA

July, 2000: Ph.D. (Marine Sediment Dynamics), Institute of Oceanology, Chinese Academy of Sciences (China)
July, 1997: M.Sc. (Coastal Geomorphology and Sedimentology), Department of Geography, Nanjing Normal University (China)
July, 1994: B.Sc. (Geomorphology and Quaternary Geology), Department of Geo-Ocean Sciences, Nanjing University (China)

### RESEARCH INTERESTS

Marine Sediment Dynamics; Benthic Boundary Layer Processes; Estuarine and Coastal Morphodynamics

### RESEARCH PROGRAMMES (PI)

Monitoring and Development of support system on seabed topographical changes in Pearl River Estuary and Taiwan Shoal. Ocean special funds for scientific research on public causes (No. 201105001-2). 2011-2014. RMB 1,570,000 (about USD240,000).

Simulation on the evolution and realignment of North branch, Changjiang Estuary (No. BK2010050). Jiangsu Key NSF. 2010-2012. RMB 250,000 (about USD38,000).

Physical processes near bottom boundary layer in shallow seas with strong tides and high turbid water. China NSF (No. 40876043). 2009-2011. RMB 500,000 (about USD77,000).

Study and strategy on typical marine hazards of Hainan. Comprehensive Survey and Evaluation Program of Coastal Sea, Hainan Province (No. HN908-02-05). 2008-2011. RMB 250,000 (about USD38,000).

Sediment dynamics and associated environment response in intertidal area and estuary. Program for New Century Excellent Talents in University(No. NCET-06-0446). 2007-2009. RMB 500,000 (about USD77,000).

Wave-current dynamic processes and tidal basin system evolution over tidal flats. China NSF (No. 40576040). 2006-2008. RMB 380,000 (about USD58,000).

The estuary evolution by human activity impacts and associated hazards potential analysis. Jiangsu NSF (No. BK2006131). 2006-2008. RMB 75,000 (about USD12,000).

Siltation hazard and strategy on major embayment and estuary. National Comprehensive Survey and Evaluation Program of China Coastal Ocean (No. 908-02-03-08). 2005-2009. RMB 250,000 (about USD38,000).

Physical oceanography and marine meteorological survey in Jiangsu coastal sea. National Comprehensive Survey and Evaluation Program of China Coastal Ocean (No. JS-908-01-01). 2005-2009. RMB 921,000 (about USD140,000).

### SELECT PUBLICATIONS; Refereed Publications (English papers only)

Huang, H; **Wang, Y.P.**; Gao, S.; Chen, J.; Yang, Y., and Gao J., 2012. Extraction of morphometric bedform characteristics from profiling sonar datasets recorded in shallow coastal waters of China. *China Ocean Engineering*, 26(3), 469-482.

Yunling Liu, Y.; **Wang, Y.P**.; Li, Y.; Gao, J.; Jia, J.; Xia, X., and Gao, S., 2012. Coastal embayment long-term erosion/siltation associated with P-A relationships: A case study from Jiaozhou Bay, China. *Journal of Coastal Research*, 28(5), 1236-1246.

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# *A Special Acknowledgement To:*
# Professor Nicholas K. Coch, Ph.D., C.P.G
# CERF Lifetime Member

We are proud to acknowledge Professor Dr. Nicholas K. Coch as a Lifetime Member of the Coastal Education & Research Foundation. Dr. Coch received his Ph.D. in 1965 from Yale University with a specialization in sedimentology and coastal geology. In 1967, he joined the faculty at Queens College of the City University of New York (CUNY). He is now a Professor of Geology in the School of Earth and Environmental Sciences at Queens College of C.U.N.Y. and a member of the Doctoral Faculty of CUNY at the Graduate Center. He has co-authored two college geology textbooks (PHYSICAL GEOLOGY) and is the author of GEOHAZARDS (Pearson). In 2008, he received the President's Award for Teaching Excellence at Queens College and the John Moss Award For Excellence in College Teaching from the National Association of Geology Teachers. His research studies since 1967 have included sedimentation on the Moon, as a Principal Investigator in NASA's Lunar Sample Study Program, and shipboard studies of continental shelf, coastal and estuarine areas in the Northeast, as well as ground and aerial studies of the effects of hurricanes on coasts and urban centers.

His recent research deals with the effects of hurricanes on coasts, urban centers and inland areas, in predicting hurricane damage and in critically analyzing our coastal management policies in a time of sea level rise. He has carried out ground and aerial studies of most recent hurricanes as well as forensic studies of older (16th-20th century) hurricanes.

He is a Fellow of the Geological Society of America and a Member of The American Meteorological Society, Society of Sedimentary Geologists, National Association of Geology Teachers, American Association of Petroleum Geologists and is a Certified Professional Geologist.

Dr. Coch is an expert on Northern Hurricanes and has been a consultant to the N.Y. City Emergency Management Organization and the N.Y.S. Office of Emergency Management. He has presented hurricane seminars to emergency management and government officials in every county in southern New York as well as insurance, reinsurance and risk management groups nationwide. In 2003, he was chosen as a Sigma Xi Distinguished Lecturer for 2004-2007, and presented lectures on his research at educational and research facilities in the U.S. and Canada.

Programs including aspects of his hurricane research have aired on the CNN, PBS, Weather, Discovery, History and National Geographic Channels, and in local, national and international news programs and periodicals.

**Selected Publications:**

**Coch, N.K.**, 2015. Unique vulnerability of the New York-New Jersey Metropolitan Area to Hurricane Destruction. *Journal of Coastal Research*, 31(1), 196-212.

**Coch, N.K.**, 2013. A field course in tropical coastal geology. *Journal of Coastal Research*, 29(6A), 214-225.

**Coch, N.K.**, 2006. The unique vulnerability of the Northeast U.S. to hurricane damage. Geologic Society of America, Abstract with programs, National G.S.A. Meeting (Philadelphia, Pennsylvania).

**For a complete list of Dr. Coch's publications or his contact information, please visit:**
**http://www.qc.cuny.edu/Academics/Degrees/DMNS/sees/People/Pages/FacultyResearch.aspx?ItemID=23**

CUNY The City University of New York


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# *A Special Acknowledgement To:*

## Hany Elwany, Ph.D.

## CERF Lifetime Member

**President, Coastal Environments**
**2166 Avenida de la Playa**
**La Jolla, California, U.S.A.**

We are proud to acknowledge Dr. Hany Elwany as a Lifetime Member of the Coastal Education & Research Foundation. Dr. Elwany received a B.S. degree in Engineering from Alexandria University in 1971. In 1977, he completed his Ph.D. at the University of Dundee, United Kingdom. He obtained an additional B.S. degree in Mathematics and Statistics at Alexandria University in 1980. Dr. Elwany has extensive experience with nearshore oceanography, coastal processes, coastal engineering, and estuarine dynamics. He was the principal investigator for the physical oceanographic program of one of the largest environmental studies ever conducted on the U.S. west coast (at San Onofre). He has conducted in-depth studies of Nile Delta erosion, particularly since the construction of the Aswan Dam. His experience also includes projects involving optimization, numerical modeling, structural dynamic analysis, design of offshore structures, and data analyses, simulation, and dynamic modeling of ocean and coastal conditions. As an educator, both at Liverpool and Alexandria Universities, he taught courses in dynamics, statistics, numerical analysis, computer applications, and maritime engineering.

Dr. Elwany also serves as the President of Coastal Environments, a unique multi-disciplinary oceanographic, coastal engineering, and environmental consulting firm. Coastal Environments, founded in 1988, is comprised of over 30 professional associates, all experts in their respective fields. Technical specialties include coastal and ocean engineering, engineering geology, oceanography, marine biology and geology, environmental analysis, economics, statistics, and computer programming/modeling.

**For more information about Dr. Elwany and Coastal Environments, please visit:**

**http://coastalenvironments.com/**



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*A Special Acknowledgement To:*

# Björn Kjerfve, Ph.D., Chancellor

## CERF Lifetime Member

**American University of Sharjah**
**PO Box 26666, Sharjah**
**United Arab Emirates**
**http://www.aus.edu**
**bkjerfve@aus.edu**

We are proud to acknowledge Dr. Björn Kjerfve as a Lifetime Member of the Coastal Education & Research Foundation. He is the former Dean of the College of Geosciences and was a Professor of Oceanography at Texas A&M University, 2004-2009. While at Texas A&M, he oversaw four academic departments, the Texas Sea Grant Program, and the Integrated Ocean Drilling Program (IODP), including the 475'ocean sciences drilling vessel, D/V JOIDES Resolution. Kjerfve was previously Professor of Marine and Geological Sciences at the University of South Carolina, 1973-2004, and served as the Director of the Marine Science Program, 2000-2004. He received Ph.D., M.S., and B.A. degrees from Louisiana State University (Marine Sciences), University of Washington (Oceanography), and Georgia Southern University (Mathematics), respectively.

Professor Kjerfve's expertise is coastal and estuarine physical oceanography. He has published some 12 books and 250 scientific journal papers, book chapters, and reports; has supervised 14 Ph.D. dissertations and 24 M.S. theses, and taught more than 6,000 oceanography students. His research includes problem-solving in estuarine and coastal waters as well as climate change and has attracted $20 million in research funding for 90 projects. Dr. Kjerfve's field research has taken place along the East and Gulf coasts of the USA, the Caribbean, Brazil, Mexico, Colombia, Chile, Thailand, Malaysia, the Persian Gulf, Papua New Guinea, and Australia. Dr. Kjerfve was elected as a corresponding member of the Academia Brasileira de Ciências, the Brazilian Academy of Sciences in 2012. Dr. Kjerfve has served as the President of the World Maritime University from 2009 to 2014. He now has the great honor of serving as the fourth Chancellor of the American University of Sharjah in the UAE.

Selected Publications:

Cavalcante, G.H.; **Kjerfve, B.**; Bauman, A.D., and Usseglio, P., 2011. Water currents and water budget in a costal mega-structure, Palm Jumeirah Lagoon, Dubai, UAE. *Journal of Coastal Research*, 27(2), 384-393.

Cavalcante, G.H.; **Kjerfve, B.**; Knoppers, B., and Feary, D.A., 2010. Coastal currents adjacent to the Caeté Estuary, Pará Region, North Brazil. *Estuarine Coastal and Shelf Science*, 88(1), 84-90.

Medeiros, C. and **Kjerfve, B.**, 2005. Longitudinal salt and sediment fluxes in a tropical estuary: Itamaracá Brazil. *Journal of Coastal Research*, 21(4), 751-758.

Perillo, G.M.E. and **Kjerfve, B.**, 2005. Regional estuarine and coastal systems of the Americas: An introduction. *Journal of Coastal Research,* 21(4), 729-730.

For a complete list of Dr. Kjerfve's publications or
his contact information, please visit: http://www.aus.edu


*Continued on Next Page*

# *A Special Acknowledgement To:*

# Associate Professor Wei Zhang, Ph.D.

# CERF Lifetime Member

**State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering**
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Dr. Wei Zhang works as an associate professor of Harbor, Coastal, and Offshore Engineering in State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, Hohai University. He focuses on the tidal current, sediment and salinity movement and transportation laws of estuaries and coasts. Dr. Zhang has published over 20 papers in recent years, including five papers indexed by SCI and EI. He took part in one Key Project of National Nature Science Foundation of China, one 95th Year Key Science and Technology Project for the Ministry of Transport, and two Science and Technology Research Projects of Guangdong Province. He has also led youth projects for the National Nature Science Foundation.


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# *A Special Acknowledgement To:*
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Chuck Thibault is currently a Ph.D. candidate at the University of Memphis and a Geologist for EarthCon, Inc. Mr. Thibault received his M.S. from the University of Washington (Geology) and a B.S. from the University of Memphis (Geology). His research interests include coastal and environmental hydrogeology and coastal geomorphology. His current research investigates the movement of storm surge generated saline water plumes through coastal surficial aquifers. Mr. Thibault's field research has taken place along the U.S. coasts of Mississippi, Louisiana, and Washington, and on the eastern coast of Kamchatka, Russia.

**For more information, please contact Mr. Thibault at: cthibalt@memphis.edu**

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# *A Special Acknowledgement To:*
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We are proud to acknowledge Dr. Erik Van Wellen as a Lifetime Member of the Coastal Education and Research Foundation. Dr. Van Wellen received M.Sc. degrees from both the Artesis Antwerpen (Civil Engineering) and the University of Liverpool (Maritime Civil Engineering). In 1999, he subsequently received his Ph.D. from the University of Plymouth with a specialization in sediment transport modeling. He has authored several papers in prominent international journals and conference proceedings.

He has research interests in the fields of natural marine sediment dynamics and mechanically driven sediment transport, renewable energy, carbon-economics, operational optimization, data analyses and mathematical simulations. During his time on the EuDA (European Dredging Association) Environment Committee he fostered a keen interest in Integrated Coastal Zone Management strategies and how to best balance the competing interests of developments such as harbor facilities, coastal defenses, tourism infrastructures and coastal environment conservation; including how best to strike a balance with mitigation and compensation.

He has previously worked as a commercial diver; and since 1999 has worked for the DEME Group (Dredging, Environmental and Marine Engineering) where he has held several operational, technical and commercial roles in a worldwide setting and is currently employed as an international Project Director.

He is a Fellow of the Institution of Civil Engineers and a Fellow of the Royal Geographical Society, a Member of the Chartered Institute of Arbitrators and a Member of the CEntral Dredging Association. Dr. Van Wellen is a Registered Professional Engineer in continental Europe (EUR ING), the UK (CEng) and internationally IntPE(UK). He is considered an expert in such matters as Civil Engineering, Maritime Construction and Dredging; and has considerable knowledge in the field of contract law and alternative dispute resolution. He also has several patents related to aforementioned technical fields registered to his name.

When not working on engineering or maritime construction projects he can be found teaching diving as a Staff Instructor for the Professional Association of Diving Instructors or actively involved in conservation work such as Dive Against Debris or Project AWARE Shark Conservation. His outstanding underwater photographs have graced the cover of the *Journal of Coastal Research* (JCR) more than once.

**For a complete list of publications and more information, please contact Dr. Van Wellen via Skype on: vanwellenerik.**


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# *A Special Acknowledgement To:*

# Frédéric Bouchette, Ph.D.

## CERF Lifetime Member

**Associate Professor of Littoral Dynamics**
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Following a M.Sc. in physics and mechanics, Fred Bouchette received his Ph.D. in March 2001 from the University of Montpellier, South of France. The title of the thesis is Wave/Seabottom Interaction: The Liquefaction Process (free translation from French; advisor: Professor M. Séguret). After his Ph.D., Fred had been employed at the University of Montpellier as an associate professor in the department of Geosciences. From 2008 to early 2011, he had moved to the Institute of mathematics and modeling of Montpellier for a three years long stay. Then, until 2012, he has been hosted as an invited professor in the METOS laboratory at the University of Oslo, Norway. He is now back to the University of Montpellier in the same department of Geosciences.

From 2002, Fred was asked to build a scientific staff on littoral hydro-morphodynamics called GLADYS (www.gladys-littoral.org). From that time, the group GLADYS has grown progressively. At now, Fred co-leads the group GLADYS, which rallies most of the scientists working on littoral hydro-morphodynamics along the French Mediterranean Coast, with distinct approaches ranging from applied mathematics to geosciences.

The scientific activity of Fred Bouchette concerns the development of concepts and methods in relation with the dynamics of shallow water environments. He studies the domain that extends from a few tens of meters of water depth at sea to the coastal watershed onshore, with a strong emphasis on the littoral area and the shoreline itself. He has worked in Spain, Taiwan, Canada, Norway, Chad, Italy, Greece, Switzerland, Tunisia, in the French Alps and in the Gulf of Lions (Mediterranean Sea). As testified by his publications, his research combines various points of view from geophysics to geology, including applied mathematics, civil engineering, quantitative geomorphology, with a strong connection to coastal archeology and the analysis of littoral hazards. Nevertheless, his heart's passion still lies with geophysics and applied mathematics.

Presently, Fred Bouchette actively works on the conceptualization of the growth of long term shoreline instabilities such as cuspates or sand spits. On that topic, his last contribution for the *Journal of Coastal Research* (JCR) is the following proceeding:

**Bouchette, F.; Manna, M.; Montalvo, P.; Nutz., A.; Schuster, M., and Ghienne, J.-F., 2014. Growth of cuspate spits. *In*: Green, A. and Cooper, J.A.G. (eds.), *Proceedings from the International Coastal Symposium (ICS) 2014 (Durban, South Africa)*. *Journal of Coastal Research*, Special Issue No. 70, pp. 47-52.**

Fred Bouchette has published>50 papers and short papers in international journals such as *Coastal Engineering*, *Journal of Coastal Research*, *Discrete and Discontinuous Dynamical Systems*, *Journal of Geophysical Research*, *Sedimentology*, *Continental Shelf Research*, *Quaternary Research*, *Ocean Engineering*, *Marine Geology*, *and Climate Research*. Most of his works were performed with and for students. He has contributed to more than 80 proceedings in international or domestic conferences. Fred Bouchette also heads the scientific development of a HPC numerical platform for coastal engineering (www.mirmidon.org).

**For a complete list of publications and more information, please visit:**
**www.bouchette.org**

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# *A Special Acknowledgement To:*

# Dr. Stephen P. Leatherman
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We are proud to acknowledge Dr. Stephen P. Leatherman as a Lifetime Member of the Coastal Education and Research Foundation (CERF). Dr. Leatherman is Professor and Director of the Laboratory for Coastal Research at Florida International University. He received his Ph.D. in Environmental (Coastal) Sciences from the University of Virginia, and completed his undergraduate degree in Geosciences at North Carolina State University.

Prior to joining FIU, Stephen was Professor and Director of the Laboratory for Coastal Research at the University of Maryland; Director of the National Park Research Unit at the University of Massachusetts, Amherst; and Assistant Professor in the Department of Geology at Boston University.

Stephen has authored or edited 16 books, including Sea Level Rise: Causes and Consequences; Barrier Island Handbook; Overwash Processes; Cape Cod: From Glaciers to Beaches; and America's Best Beaches. He has also authored over 200 journal articles and technical reports, including articles in both Science and Nature.

Stephen has provided expert testimony multiple times for the U.S. Senate and U.S. House of Representatives. He was also the on-screen host and co-producer of the 1992 film "Vanishing Lands", winner of three international film awards, including the Golden Eagle.

**For more information, please contact Dr. Leatherman at:**
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*Continued on Next Page*

# *A Special Acknowledgement To:*

# Dr. Philip D. Osborne
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We are proud to acknowledge Dr. Philip D. Osborne as a Lifetime Member of the Coastal Education and Research Foundation (CERF). Dr. Osborne is the Principal Senior Coastal Geomorphologist at Golder Associates [British Columbia, Canada]. Of particular note was when a Certificate of Achievement in the technological and ecological safety contribution category was presented to Dr. Osborne by Confidence Capital and the Organization for Security and Co-operation in Europe (OSCE) in recognition of Golder's contribution in the field of promoting environmental and industrial safety. Dr. Osborne gave a presentation at the organization's 2nd International Conference on "Onshore and Offshore Oil Spills: Prevention and Response" conference held in Almaty, Kazakhstan in March 2013, where his topic was the Experimental Offshore Air & Water Quality Monitoring System (AWQMS) for the D-Island. He spoke about Golder's experience with the installation and first year of operation of the water quality monitoring system in the North Caspian Sea being used to establish project baseline and an early warning system for project related environmental impacts.

Established in 1960, Golder is a global, employee-owned organization driven by the purpose to engineer earth's development while preserving earth's integrity. Their goal is to help their clients find sustainable solutions to the challenges society faces today including extraction of finite resources, energy and water supply and management, waste management, urbanization, and climate change. Golder does this by providing a wide range of independent consulting, design and construction services to their clients in specialist areas of earth, environment, and energy.

**For more information, please contact Dr. Osborne at:**
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# *A Special Acknowledgement To:*

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We are proud to acknowledge Dr. Yoshiki Saito as a Lifetime Member of the Coastal Education and Research Foundation (CERF). Dr. Saito (D.Sc.) is the Prime Senior Researcher and Leader of the Coastal Sedimentology Research Group for the Institute of Geology and Geoinformation (IGG) at the Geological Survey of Japan (GSJ), AIST. His principle research interests are shallow marine sedimentology, modern sedimentary processes, sequence stratigraphy, strata formation, and human impacts. Current projects that Dr. Saito is working on include deltas in Southeast and East Asia, strata formation, sequence stratigraphy, morphodynamics, and modern sedimentary processes of deltas and incised-valley fills, with close links to sea-level changes, climate changes and human impacts. His credentials also include Leader of the Asian Delta Project (IGG/AIST), Co-Leader of IGCP-475 "Deltas in the Monsoon Asia-Pacific region: DeltaMAP", Leader of CCOP "Integrated Geological Assessment of Deltas in the SE and E Asian region: DelSEA-II" Project, and Leader/Chief Coordinator of JSPS AA Science Platform Program "Mega-Delta Watching in Asia: Networking and Capacity Building.

**For more information, please contact Dr. Saito at:**
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# *A Special Acknowledgement To:*

# Prof. Dr hab. Kazimierz Furmańczyk

## CERF Lifetime Member

**Remote Sensing and Marine Cartography Unit**
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We are proud to acknowledge Prof. Dr hab. Kazimierz Furmańczyk as a Lifetime Member of the Coastal Education and Research Foundation (CERF). Dr. Furmańczyk is currently Full Professor at the University of Szczecin and co-founder (with prof. S. Musielak) of the Institute of Marine and Coastal Sciences (IMCS). His active research interests include morphodynamics of the coastal zone using remote sensed methods. Since 1991, Dr. Furmańczyk has been a Polish coordinator of several EU Projects: BASYS, CoastLearn, EUROSION, MESSINA, and MICORE. Together with his staff, he has also participated in the SatBałtyk project (Satellite monitoring of the Baltic Sea) since 2009. Dr. Furmańczyk is also responsible for lecturing at Erasmus (IP) international summer schools: on ICZM in Porto (2002) and Ponta Delgada (2003); on *Multidisciplinary Approach to Flood Risk Analysis - IMARA* in Italy (2010-2012); *Multirisk Assessment and Mitigation in Europe MIRAME* in San Giovanni Valdarno - Italy (2013) and Aveiro – Portugal (2014); and also at the Erasmus Mundus study on *Water River and Coastal Management* in Faro - Portugal. He served as the Chair and Organizer of the 11th International Coastal Symposium (ICS) at Szczecin University (Poland) in 2011.

In 1999, Dr. Furmańczyk received the Fulbright Senior Grant when he visited the University of Florida in Gainesville. He was also given a German DAAD grant for visiting the Christian Albert University of Kiel. Dr. Furmańczyk is an initiator and editor of a periodic: *ICZM in Poland – present state and perspectives*, edited by University of Szczecin. Since 2005, he has edited 5 volumes and has several achievements in research of the South Baltic coastal development regularities, which were provided in numerous papers. Recently, the greatest achievements of his staff are: construction of a prototype of *Early Warning System – Storm impact forecasting* www.micore.eu and construction of sub-system, SatBaltic - Coast" as a part of SatBałtyk system www.satbaltyk.pl

**Selected Recent Publications:**

• Musielak, S.; **Furmańczyk, K.**, and Bugajny N., in press. Factors and processes forming the Polish Southern Baltic Sea coast on various temporal and spatial scales. *In*: Harff, J.; Furmanczyk, K., and von Storch, H. (eds.), *Coastline changes of the Baltic Sea from South to East - Past and Future Projection*. Coastal Research Library (CRL), Dordrecht, The Netherlands: Springer International Publishing.

•Bugajny, N. and **Furmańczyk, K.**, in press. Comparison of short-term changes caused by storms along natural and protected sections of the Dziwnow Spit, Southern Baltic Coast. *Journal of Coastal Research*.

• **Furmańczyk, K**. and Musielak, S., 2015. Polish spits and barriers. *In*: Randazzo, G.; Jackson, D.W.T., and Cooper, J.A.G. (eds.), *Sand and Gravel Spits*. Coastal Research Library (CRL), Volume 12, Dordrecht, The Netherlands: Springer International Publishing, pp. 181-195.

• Bugajny, N. and **Furmańczyk, K.**, 2014. Dune coast changes caused by weak storm events in Miedzywodzie, Poland. *In*: Green, A.N. and Cooper, J.A.G. (eds.), *Proceedings from the International Coastal Symposium (ICS) 2014* (Durban, South Africa). *Journal of Coastal Research*, Special Issue No. 70, pp. 211-216.

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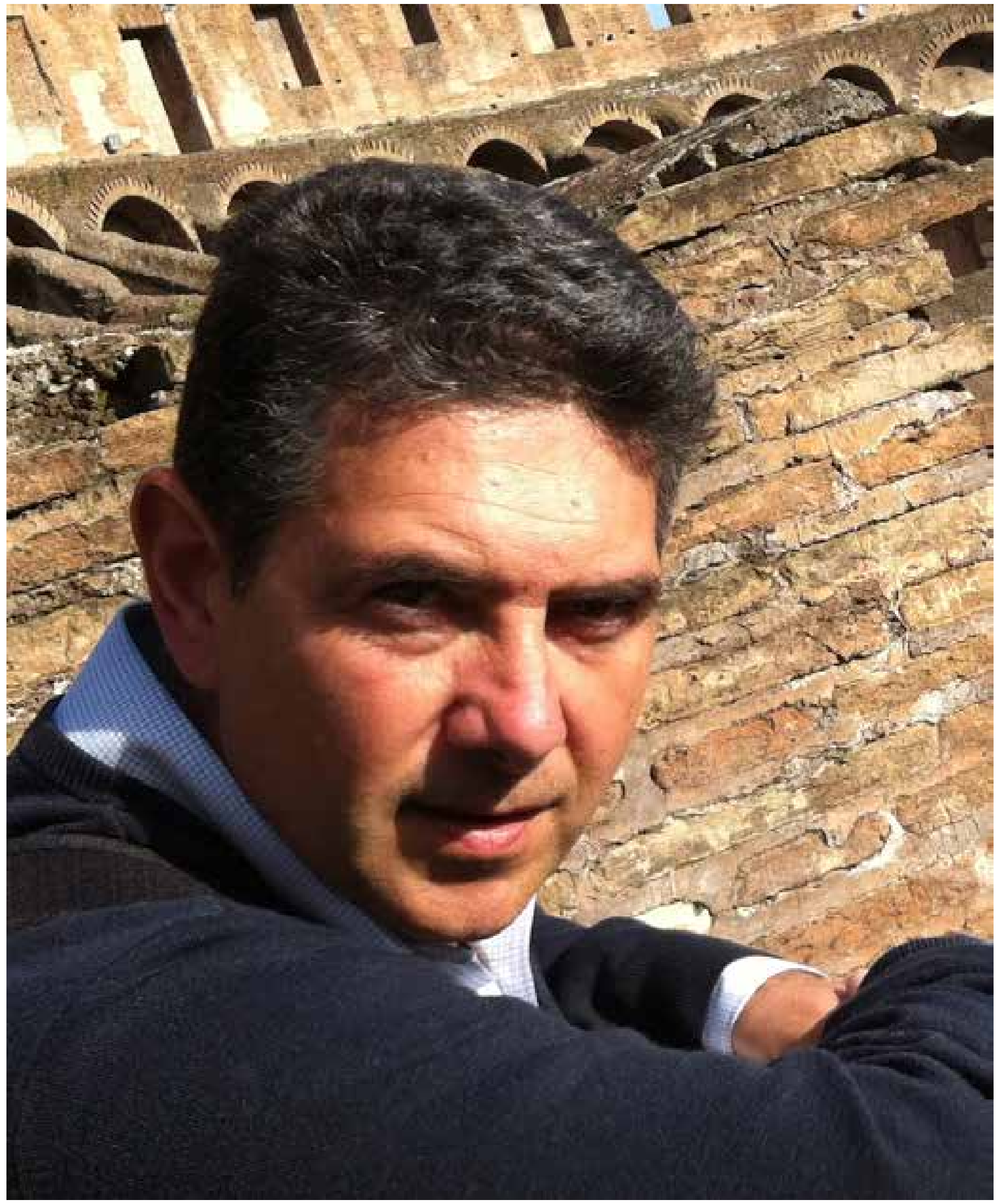
*A Special Acknowledgement To:*

# Dr. Gonzalo Malvárez

## CERF Lifetime Member



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# *A Special Acknowledgement To:*

## Dr. Fatima Navas
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Dr. Fatima Navas is head of the "Coastal Environments" Research Group (RNM-911) and Profesora Titular at Universidad Pablo de Olavide in Seville (Spain). She is also Sponsor Associate at Ulster University (UK). She has extensive experience in coastal processes, integrated coastal zone management, coastal tourism and spatial data information and mapping. Her research focuses in coastal morphodynamics, environmental impacts caused by human activities in coastal areas, sustainable management for tourism development in the Mediterranean, as well as storminess and environmentally sensitive coastal areas of the European Union. She is involved with the design and implementation of higher education programs, both graduate and postgraduate, as well as participated in numerous research projects, such as the EU ECHO Civil Protection FLOOD-CBA, ECOSHAZ, FLOOD-CBA#2, EU FP7 Program PEGASO, MEDINA Projects, and EU MED Program COASTGAP, among other projects. Her scientific work has been published in international impact index journals such as, for example, *Geology*, *Marine Geology*, *Journal of Coastal Research*, *Journal of Coastal Conservation*, *Journal of Tourism Management, and Coastal Engineering.*

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# COVER PHOTOGRAPH:

## Kimberley Coast, Buccaneer Archipelago, Western Australia

Kimberley Coast, Buccaneer Archipelago, Western Australia. Coastal features and mangroves in the southern part of the Kimberley Coast, in the vicinity of the Buccaneer Archipelago, northwestern Australia, usually show isoclinally-folded Proterozoic sandstones, volcanic rocks, and ironstones of the King Leopold Mobile Belt (or Orogen). These features tectonically adjoin the southern part of the Proterozoic Kimberley Basin, as they crop out and form seaward projecting peninsulas (Brocx and Semeniuk, 2011). Evident in this image is the terrain of linearly-oriented fold limbs and, in this particular case, an eroded anticline structure, where the eroded crest of the fold comprises a linear deeply-invaginated embayment that is flanked by linear ridges. The linear ridges themselves, usually comprised of sandstone bluffs, are bordered by scree slopes that are evident as vegetated steeply-sloping terrain adjacent to the bluffs. The linear embayment, that has been flooded by the Holocene transgression, is mud-floored.

The Kimberley Coast is a macrotidal mangrove coast. As shown in the image above, which was taken at high tide, the mangroves inhabit the entire tidal length of the linear embayment. Lining rocky shores and inhabiting scree slopes, the mangroves further seaward are eventually succeeded by sandy slopes and mud flats. Several species of mangroves occur in this area and, in the context of rocky shores, inundated scree slopes, and grading seawards to sand and mud, they form a weak zonation (Cresswell and Semeniuk, 2011). The most clearly evident mangroves are *Rhizophora stylosa* (and some *Bruguiera exaristata*) forming the dark green zone mostly along the shore, *Avicennia marina* (the yellow-green mangrove), and more seaward *Sonneratia alba* (the grey-green mangrove). *A. marina* occurs seawards of the *Rhizophora* zone and also forms a thin band between the *Rhizophora* and the high-tide mark further into the embayment. Topographic variation such as tidal creeks, tidal creek levees, and shoals are made evident by the variation in mangrove species occurrence. (Photograph taken September 2010 by Vic Semeniuk, V & C Semeniuk Research Group, Warwick, Western Australia.)

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The Coastal Education & Research Foundation *[CERF]* graciously thanks you for your membership and involvement in our international society. We hope that you have enjoyed this latest edition of *Just CERFing*, our society's official newsletter. As mentioned previously, we encourage the worldwide communication of our members through the *Just CERFing* newsletter. If you have any news or announcements that you would like to promote, please send your request or questions directly to Dr. Charles W. Finkl at cfinkl@cerf-jcr.com.

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Next issue of *Just CERFing* coming August 2017.

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