Salas, J.D., Delleur, J.W., Yevjevich V., and Lane, W.L., 1980. *Applied Modeling of Hydrologic Time Series*. Littleton, CO: Water Resources Publications Ltd.
Scheffner, N.W., and Borgman, L.E., 1992. Stochastic time series representation of wave data. *Journal of Waterway, Port, Coastal and Ocean Engineering*, ASCE, **118**(4): 1955–2012.
Schneggenburger, C., Günther, H., and Rosenthal, W., 2000. Spectral wave modelling with non-linear dissipation: validation and applications in a coastal tidal environment. *Coastal Engineering*, **41**: 201–235.
Schuster, A., 1898. On the investigation of hidden periodicities with application to a supposed twenty-six day period of meteorological phenomena. *Terrestrial Magnetism*, **3**: 13–41.
Schwartz, G., 1978. Estimating the dimension of a model. *The Annals of Statistics*, **6**: 461–464.
Shumway, R.H., and Stoffer, D.S., 2000. *Time Series Analysis and Its Application*. New York: Springer-Verlag New York, Inc.
Slutsky, E., 1937. The summation of random causes as the source of cyclical processes. *Econometrica*, **5**: 105–146.
Spanos, P.D., 1983. ARMA algorithms for ocean wave modelling. *Journal of Energy Resources Technology* ASME, **105**: 300–309.
Stone, M., 1979. Comments on model selection criteria of Akaike and Schwartz. *Journal of Royal Statistical Society*, Series B, **41**: 276–278.
Tucker, M.J., 1991. *Waves in Ocean Engineering*. New York: Ellis Horwood Limited.
Vandaele, W., 1983. *Applied Time Series and Box–Jenkins Models*. New York: Academic Press.
Walker, G., 1931. On periodicity in series of related terms. *Proceedings of the Royal Society*, A **131**: 195–215.
Walton, T.L., Jr., 1999. Shoreline rhythmic pattern analysis. *Journal of Coastal Research*, **15**(2): 379–387.
Wei, W.W.S., 1990. *Time Series Analysis. Univariate and Multivariate Methods*. Redwood City, CA: Addison-Wesley Publishing Company, Inc.
Wold, H., 1938. *A Study in the Analysis of Stationary Time-Series*. Uppsala, Sweden: Almquist & Wiksell.
Yule, G.U., 1927. On a method of investigating periodicities in distributed series, with special reference to Wölfer's sunspot numbers. *Philosophical Transactions of the Royal Society*, A, **226**: 267–298.

Cross-references

Coastal Modeling and Simulation
Numerical Modeling
Simple Beach and Surf Zone Models
Surf Modeling
Wave Climate

TOPIC CATEGORIES—See APPENDIX 6

TORS

The word "tor," Celtic in origin, is used generally in the British Isles to denote a rather tall rock column (Cunningham, 1968; Jackson, 1997). Linton (1955) was the first to propose it as a scientific term in describing the tors at Dartmoor, Devonshire, England, now considered the type area for the feature (Palmer and Neilson, 1962). Early hypotheses for the origin of tors invoked deep weathering along joint planes in granite, with subsequent removal of the loose material leaving exposed columns. Alternate possibilities outlined by Cunningham (1968) include differential erosion during scarp recession and relict subaerial prominences formed in the Tertiary. Since tors have been found worldwide, often in granite but also in other igneous, sedimentary, and metamorphic rocks, it is appropriate to consider Palmer and Neilson's (1962) pronouncement that "It is not possible to offer a definition that will encompass the many landforms to which the name "tor" has been given." With such wide distribution and varied lithology it is arguable that the most scenic among all of these are coastal tors, as can be seen in the Seychelles and Virgin Islands.

Seychelles

The Seychelles, along with Madagascar, were displaced in a northeasterly direction away from the African landmass during the early formation, in the Jurassic, of the Indian Ocean (Brathwaite, 1984). As such, 42 of the 116 islands comprising the Seychelles Archipelago are the world's only mid-ocean islands composed of granitic rocks (Cílek, 1978). Grey and pink amphibolitic granite, of late Precambrian age, is spectacularly displayed on the northern island of La Digue and at Mahe as discussed by Wagle and Hashimi (1990).

La Digue Island has long been known for its world-class resorts featuring tropical flora, white-sand beaches, swimming in crystal clear waters, snorkeling among coral reefs and magnificent scenic views. Anse source d'argent beach, located on the island, is the site of several tors, chief among them that is pictured in Figure T46. The size of the pink tor can be judged when compared with the heads of the three swimmers seen in the mid-foreground. Graphic too is the weathered "fluting" described as typical of tors by Linton (1955) in his pioneering work, and by Brathwaite (1984) for a tor on Mahe.

Figure T46 The tor at Anse Source D'argent, La Digue Island, Seychelles, Indian Ocean; often considered to be the most beautiful beach in the world (Photo courtesy of New Adventures).

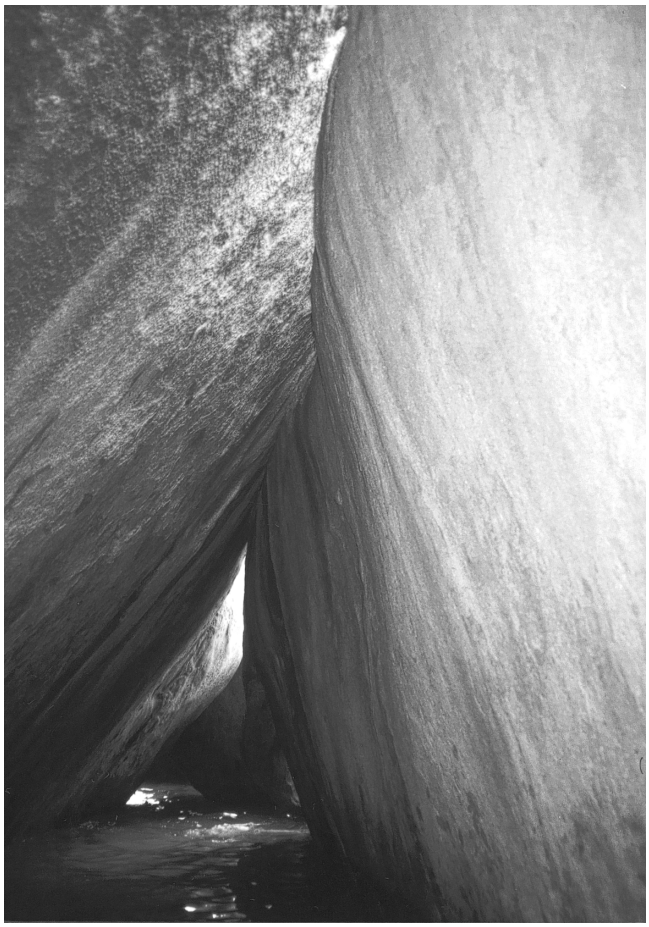

Figure T47 Grotto at the base of the tors at The Baths, Virgin Gorda, British Virgin Islands (Photo, M. Schwartz).

Virgin Islands

The Virgin Islands, located in the northeastern Caribbean along the leading edge of the Caribbean plate, are composed of Mesozoic and lower Tertiary deformed island-arc terrane. Much of the northeastern British Virgin Islands region is underlain by the Virgin Gorda granitic pluton or batholith, which was intruded into the surrounding country rock in mid- to later Eocene time (Mattson *et al*., 1990). Weathered exposures in tonalitic rocks at the southern end of the island of Virgin Gorda reveal huge boulders now located upon the beaches (Weaver, 1962) in a park system managed by the B.V.I. National Parks Trust.

The origin of these boulders has been described by Ratté (1986) in the classic Linton (1955) style for tors of deep weathering along joints followed by removal of the rotted material. A favorite with tourists, the site is called "The Baths," not because of the underlying batholith as a geologist would imagine, but for the salt water pools in the grotto at the base of the tors (Figure T47). Here one may walk, and crawl, along a trail between boulders that range up to 4 m in height.

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Bibliography

Brathwaite, C.J.R., 1984. Geology of the Seychelles, In Stoddart, D.R. (ed.), Biogeography and ecology of the Seychelle Islands. The Hague: W. Junk, pp. 17–38.

Cílek, V., 1978. Geological investigations on the beaches of Mahe in the Seychelles Archipelago. *Casopsis pro Mineralogii a Geologii*, **23**(2): 149–157.

Cunningham, F.F., 1968. The significance of Caribbean evidence in the elucidation of tors. *Caribbean Journal of Science*, **8**: 187–197.

Jackson, J.A. (ed.), 1997. Glossary of Geology, 4th edn. Alexandria, VA: American Geological Institute.

Linton, D.L., 1955. The problem of tors. *Geographical Journal*, **121**(4): 470–486.

Mattson, P., Draper, G., and Lewis, J.F., 1990. Puerto Rico and the Virgin Islands. In Dengo, G., and Case, J.E. (eds.), *The Caribbean Region, The Geology of North America*, H, Boulder: Geological Society of America, pp. 112–120.

Palmer, J., and Neilson, R.A., 1962. The origin of granite tors on Dartmoor, Devonshire. *Proceedings of the Yorkshire Geological Society*, **33**(3): 315–339.

Ratté, C.A., 1986. *The Story of the Boulders*. Burlington, Vermont: Queen City Printers.

Wagle, B.G., and Hashimi, N.H., 1990. Coastal geomorphology of Mahe Island, Seychelles. *International Journal of Remote Sensing*, **11**(2): 281–287.

Weaver, J.D., 1962. Notes on some erosional features in Virgin Gorda, B. Virgin Islands. *Caribbean Journal of Science*, **2**(4): 159–167.

Cross-references

Boulder Beaches
Caribbean Islands, Coastal Ecology and Geomorphology
Coastal Hoodoos
Indian Ocean Islands, Coastal Ecology and Geomorphology
Tourism, Criteria for Coastal Sites
Weathering in the Coastal Zone

TOURISM AND COASTAL DEVELOPMENT

Coastal tourism is a process involving tourists and the people and places they visit. It is more specifically defined as tourism brought to bear on the coastal environment and its natural and cultural resources. Most coastal zone tourism takes place along the shore and in the water immediately adjacent to the shoreline. Coastal tourism activities occur outdoors and indoors as recreation, sport and play, and as leisure and business (Miller and Ditton, 1986). As with other human endeavors in the coastal zone associated with development, tourism is viewed positively by some for the opportunities it creates. Others condemn coastal tourism for its unacceptable consequences.

Coastal tourism destinations fall all along an urban–rural continuum (see *Demography of Coastal Populations, q.v.*). At one end of the scale are major cities and ports (Hong Kong, Venice, New York, Rio de Janeiro, and Sydney come to mind) known for their cultural, historical, and economic significance. At the other end of the continuum are the relatively isolated and pristine coastlines found around the world that are valued for their natural beauty, flora, and fauna. Of course, many coastal tourism destinations offer rich mixtures of cultural, historical, social, environmental, and other values to visitors.

Coastal tourism technologies of travel include both those which carry tourists from their homeland (e.g., airplanes, ships, cars, buses, and trains) and which are regarded by travelers as mere means to the end of arriving at destinations, and those which transport tourists at coastal destinations but which become part of the touristic experience (e.g., cruise ships, personal watercraft, sailboats, dive boats, motorcycles, bicycles, and forms of animal transportation). Again, some transportation technologies can, depending on the circumstance, be important for being both convenient and for being interesting or pleasing.

In a manner of speaking, all tourism is a matter of supply and demand. With this perspective, coastal tourism is a business for those who make a living by developing accommodations and attractions, and by providing touristic and recreational products and services. Competing marketing programs of a multifaceted industry alert tourists and would-be travelers to coastal tourism amenities. Today, tourists travel to the coastal zone for parts of a day, for weekends, for short vacations, and for prolonged stays. Depending on the circumstances, they may travel alone, with family, or in groups. Some coastal tourism is organized for a special purpose such as ecotourism, adventure tourism, scientific tourism, and dive tourism. Coastal tourism accommodations range from small residences and camping sites rented out as opportunities arise, to single bed-and-breakfast and hotel rooms, to luxury suites in resort enclaves.

Many coastal tourism activities count as a business for those in the tourism industry and as an experience for tourists. Scuba diving, for example, provides an excellent example of how advances in technology have provided foundations for business and have facilitated touristic access to the marine environment. Other coastal activities that have a business aspect (involving, for example, guides and instructors, or

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