Geomorphological evolution of coral reefs, shorelines, and sabkha at Bar Al Hikman (Arabian Sea, Oman): Past, Present, and Future

Thomas Teillet*[1], Perrine Bois[1], Peter Homewood[2], Monique Mettraux[2], and Volker Vahrenkamp[1]

[1]KAUST - King Abdullah University of Sciences and Technology – Arabie saoudite
[2]GeoSolutions – - – France

Résumé

Climate changes, anthropogenic stressors, and rapid sea level rise threaten coastal areas worldwide. Especially the low-lying sandy coasts that represent one-third of the planet's coastline. In tropical areas, the presence of coral reefs safeguards the shores against the direct impact of waves. However, the worldwide decline of coral reefs since the 1950s brought new threats to many coastal areas. The Peninsula of Bar Al Hikman is a low-lying area (+0-3 m; 700 km2) on the Omani Arabian Sea coast. The southern part hosts two lagoons that provide habitat for pristine intertidal ecosystems and migratory birds. These lagoons are protected from monsoonal winds and cyclones by the world's largest monospecific coral reefs. Our study aims to understand and quantify the geomorphological coastal changes that took place between 1972 and 2023 using remotely sensed data and fieldwork observations. We report the shrinkage of about 60% of the coral reef coverage over the past 50 years. This decline happens at a rate of 14% per decade, which is twice as fast as the global reef decline. We observe the rapid erosion of 60% of the peninsula's shoreline at a rate of coastal retreat above 1m per year. In addition, 12% of the shoreline that was previously protected by reefs is retreating at a rate of more than 5m per year. The decline of coral reefs at Bar Al Hikman is likely due to multiple factors that still need to be clearly identified. The resilience of monospecific coral reefs is questioned. However, the linear rate of reef shrinkage observed over the past 50 years suggests a global-scale control, likely caused by the worldwide and ongoing rise in sea surface temperature since 1950. At the current pace (IPCC-SSP3-7.0), our predictions indicate the disappearance of the reefs by 2050. At that time, the proportion of shoreline that experiences rapid erosion is expected to increase. Due to the rapid sea level rise, a significant portion of the Peninsula will fall below the annual flood limit (Sabkha). And, finally, the closure of the lagoons is expected by 2100, resulting in the collapse of the associated ecosystems.

Mots-Clés: Reef, Coastal erosion, Geomorpholohy, anthropocene, remote sensing, sedimentology, carbonate

*Intervenant