Now is the Right Time for CORSAGE (Continuous Orbital Remote Sensing of Archipelagic Geochemical Events)

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In 1994, several years before the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) was finally launched, an ambitious project was proposed, a project entitled Continuous Orbital Remote Sensing of Archipelagic Geochemical Events (CORSAGE). The goals of this project were three–fold. The first goal was to observe the transport of carbonate sediments from coral atolls and carbonate banks to pelagic waters using satellite-based remote sensing. The second was to analyze the ocean optics of such features to enable the creation of quantification algorithms. The third was to use this information to estimate the amount of shallow-water carbonate production that is transported offshore.

While such a project was never initiated, over the following decades, several of its goals were partially realized, with publishable results. Observations of definite storm-induced carbonate sediment transport events from Bermuda, the Bahamas Banks, Cuba, and a coral atoll in the South China Sea were reported. Results from a first-principles algorithm for mass estimation of such features were published. Many subsequent storm-induced events were the subject of ongoing observations and publications in online media.

With the increasing accessibility and online availability of remotely-sensed data from multiple platforms, it has been possible to review nearly 20 years of observational data to make a preliminary characterization of the dynamics and frequency of such events. This activity also informs another sector of geoscience, the archipelagic sediment stratigraphy community, for which such observations are revolutionary and which will likely force a considerable reevaluation of sediment depositional interpretations and regimes.

Thus, in the present environment, CORSAGE is now eminently possible. A project team has been assembled for planning and evaluation, consisting of geochemists, remote-sensing scientists, sediment stratigraphers, processes sedimentologists, and data experts.

Results from initial survey efforts are being formulated and presented at this time. The ad hoc CORSAGE team envisions such a project with the five following goals:

- Detailed analysis of sedimentary processes contributing to carbonate bank formation, maintenance, and related sediment facies.

- Global quantification of transport initiation, sediment mobility, event frequency, duration, and areal extent, aided by remotely-sensed meteorological data fields including wind speed and direction and precipitation rates, using data often available at daily or sub-daily temporal resolution – allowing characterization of single event evolution.
- Ocean optical algorithm refinement, utilizing the optical characteristics of this sediment type, which is highly reflective, minimally absorptive, and non-buoyant, enabling better mass estimates.
- Enhancing models of the oceanic carbon and carbonate cycles by significantly refining our knowledge of how much and how often the most soluble carbonate polymorphs, aragonite and high-magnesian calcite, are transported into the water column where they can dissolve, an important carbon sink in the oceanic water column. Alternatively, a large volume of $CaCO_3$ can be fossilized on slopes well above the lysocline. In addition, the project can examine related carbonate chemical processes, including whitings and precipitation on existing carbonate substrates.
- The creation of infrastructure enabling in situ sampling of short-lived sediment plume optical characteristics and associated seawater carbon chemistry, utilizing rapid response sampling vessels, potentially coupled with autonomous surface and underwater vehicles equipped with state-of-the-art sensor technology.

In this lightning talk, recent results and the current status of our incomplete knowledge of these events will be discussed, followed by a brief summation of how a full-fledged CORSAGE project would address these issues, providing invaluable information to the sediment, geochemical, and ocean optical scientific communities.