POSTER #57

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ENVR SCI

Potential Anthropogenic Changes in Dove Lake (Lagoon) in the Upper Florida Keys Over the Last 100 Years

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Introduction

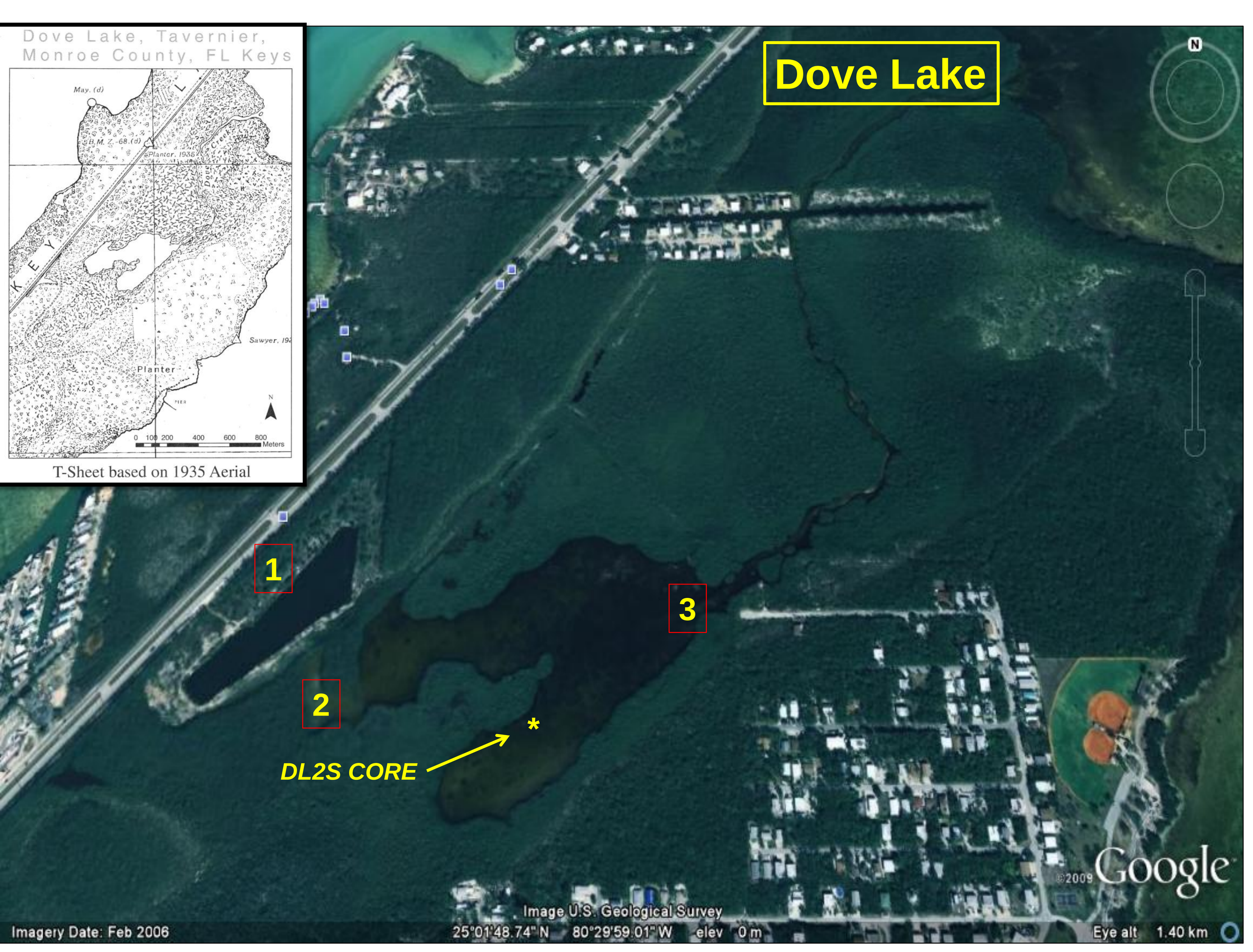
The sediment record in Dove Lake is used to investigate potential ecological shifts in response to anthropogenic modifications occurring over the last 100 years. A core was collected from Dove Lake (Lagoon), located in Tavernier, Florida. Dates and accumulation rates for the sediment core was established through ^{210}Pb dating. Lead-210 is an ideal tracer for determining dates and accumulation rates on a 100 year time scale, which is the most relevant time scale for examining consequences of recent change. It is during this time that major anthropogenic modifications have taken place within the Upper Florida Keys and surrounding areas.

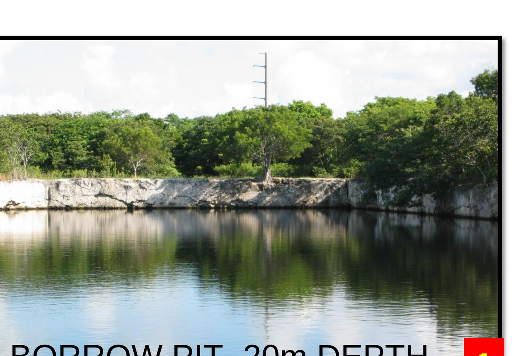
Background

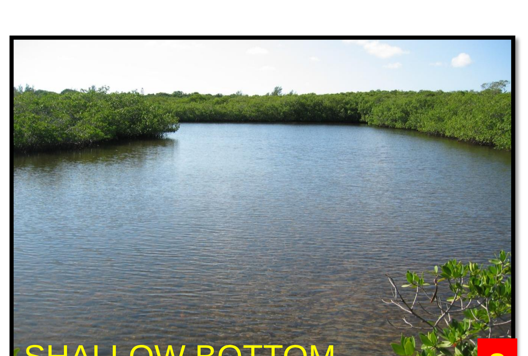
- Dove Lake is located along the upper portion of the Florida Keys geologic islands formations ***25°01'.48.47"N 80°29'59.01"W***. The Florida Keys are a chain of islands made up of two primary types of limestone: Key Largo Series and the Greater Miami Series, dated from 120-130ka during the Pleistocene period (Al Hine) The current landscape reflects an overlying karstic formation and is dominated by shallow localized soil series, such as the Tavernier and Islamorada series,.

- Dove Lake is a shallow (4m), tidal dominated marine lagoon located in Tavernier Florida. Dove Lake is connected to the Atlantic Ocean via a ~1.2km in length tidal creek located at the north-west corner of the lagoon. This area is dominated by a well developed system of red mangroves.

- Photographic evidence provided by SOFIA, shows that the over all geographic profile of the lagoon has varied little in the last 100 years (see map images below).

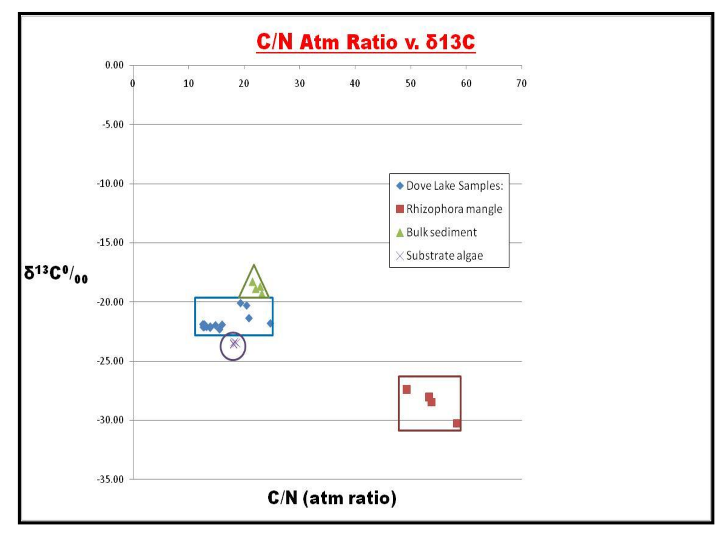


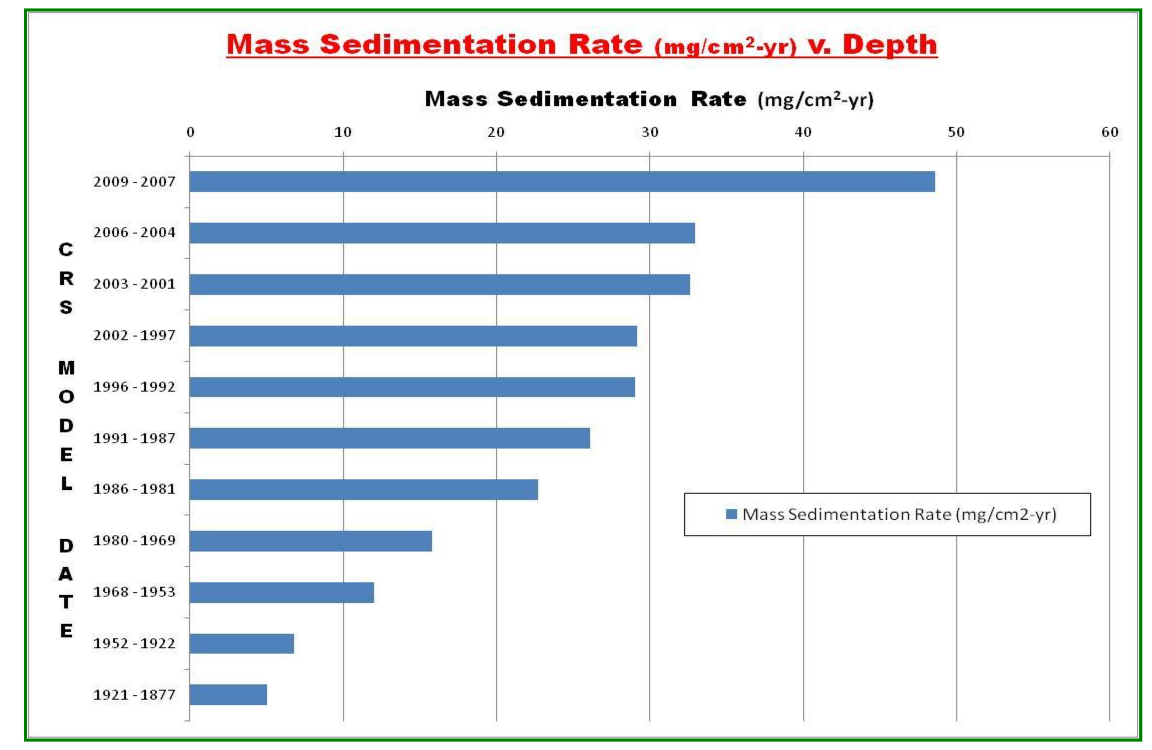


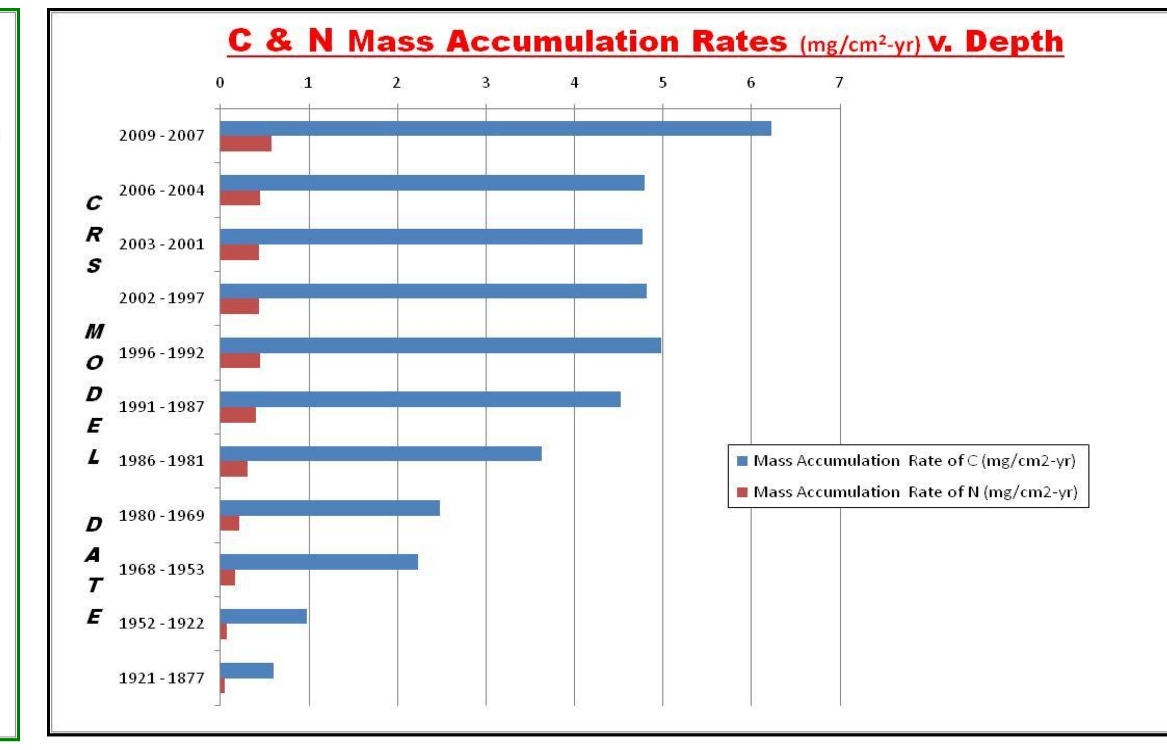


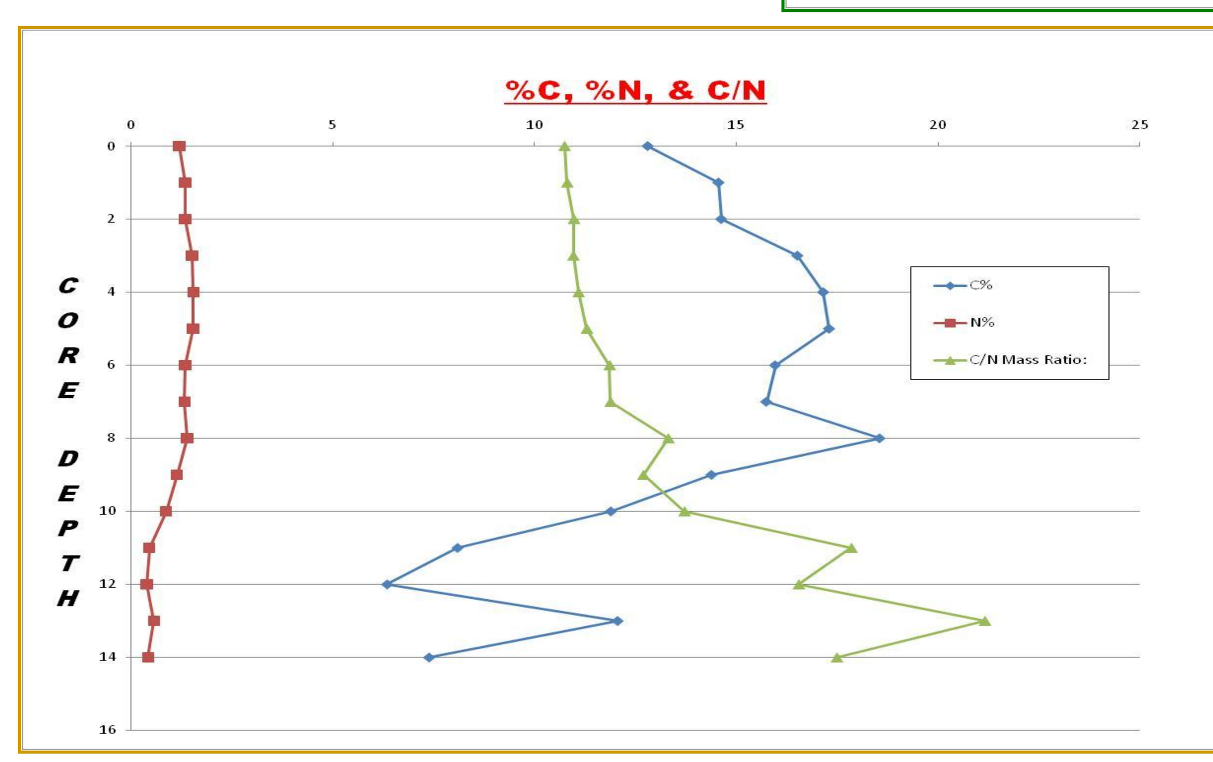
3 TIDAL RANGE: LESS THAN 8 HRS

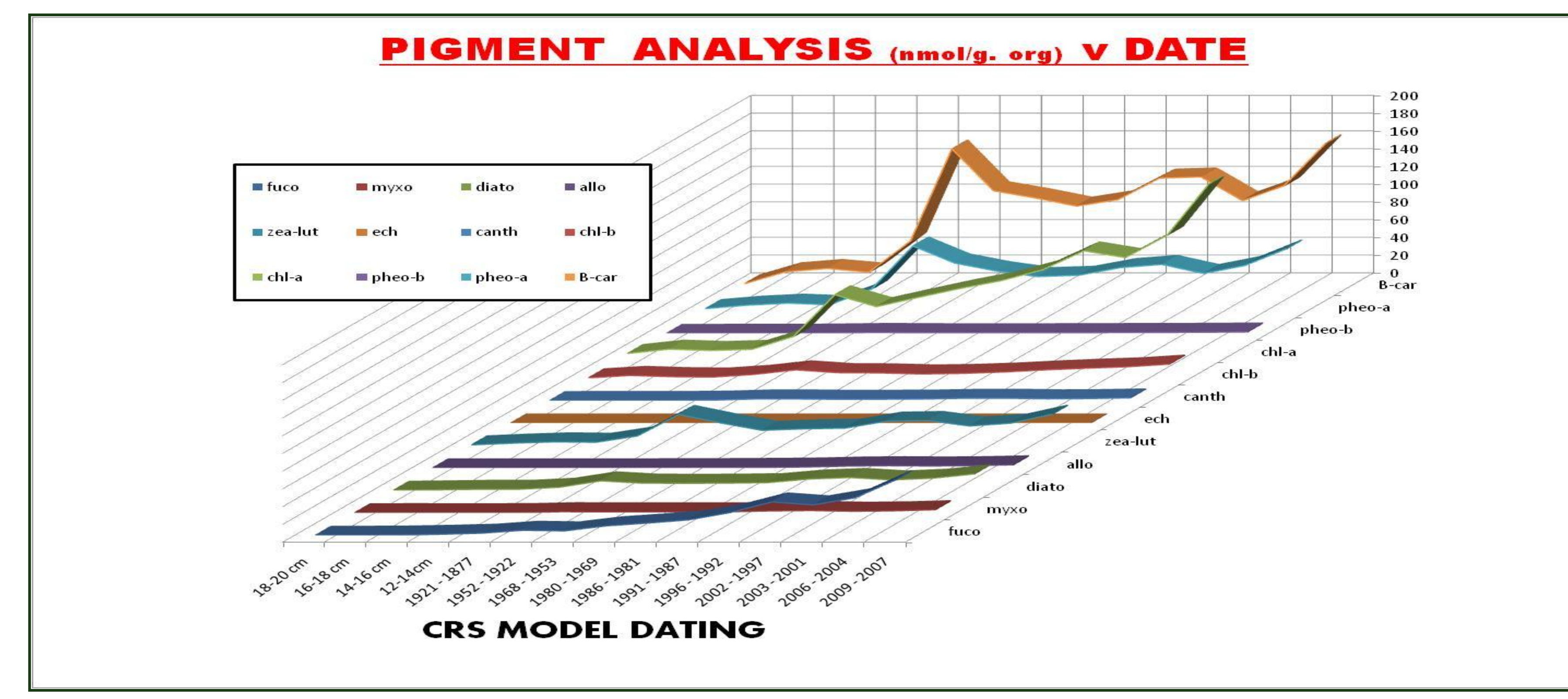
Results







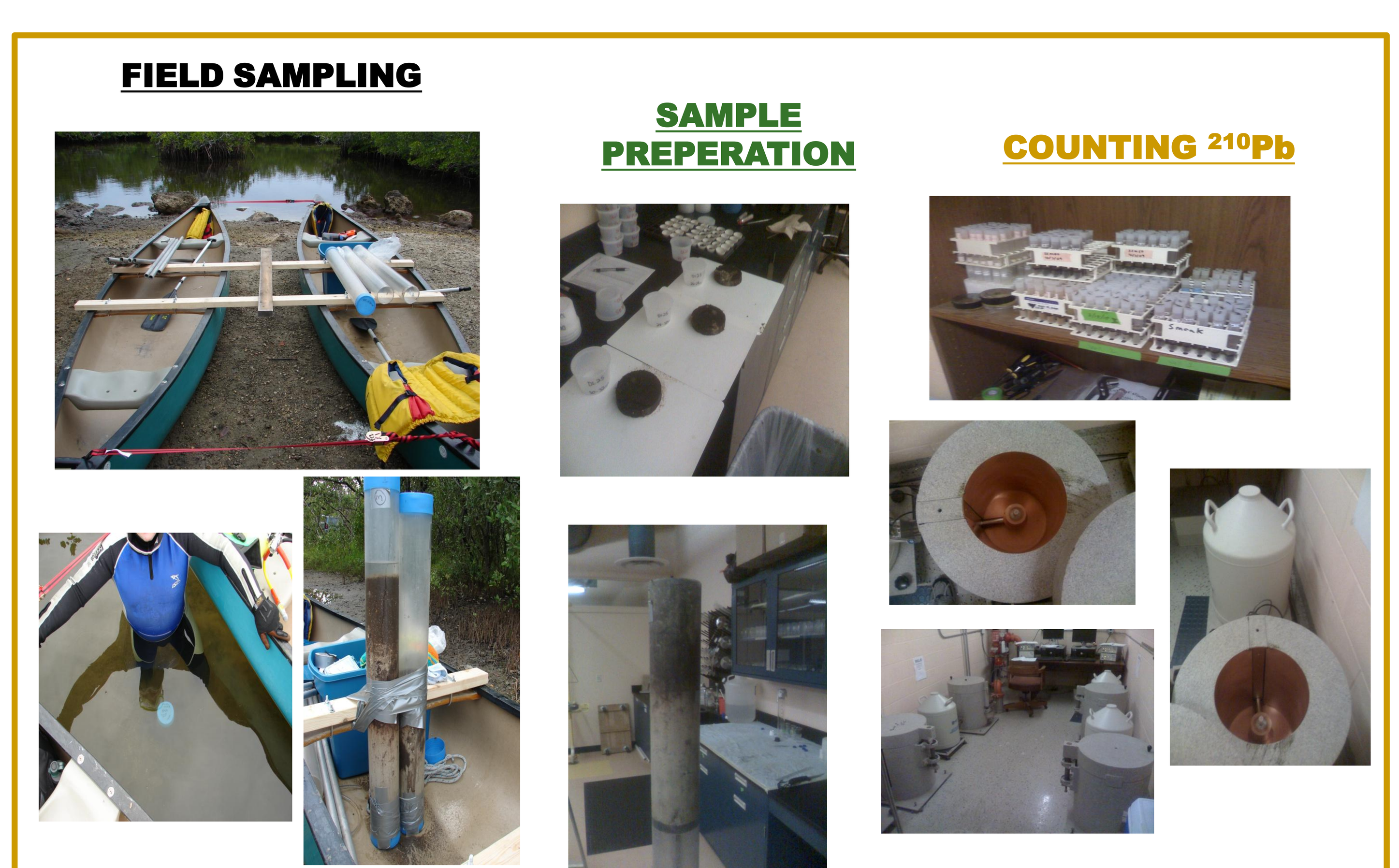




Methodology

- Total nitrogen, organic carbon, δ^{13}C and sedimentary photosynthetic pigments (chlorophylls and carotenoids) are proxies used to interpret past ecological conditions within this system.

- A subaqueous (<1m depth), sediment core was collected using clear (100cm length x10cm diameter) polycarbonate tubing, minimizing surface sediment disturbance / compaction. Short cores were later sectioned into 1cm intervals in the lab. Core sections were frozen, freeze-dried and ground with a mortar and pestle, prior to analysis. Lead-210, Organic matter (OM), δ^{13}C, total organic nitrogen (TN), total organic carbon (TC) and photosynthetic pigments were measured as follows:
  - **δ^{13}C** – Used to indicate the origins of the OM
  - **^{210}Pb**- Germanium Well Detector
  - **OM**- Loss on ignition (LOI) at 550° C
  - **TN, TOC**- C/N/S analyzer following HCL acidification (expressed as % mass)
  - **Pigments**- HPLC



Conclusions

The CRS ^{210}Pb model shows the overall trend for the mass sedimentation rate for the dating period has changed upwards approximately x10 fold. Initial mass sedimentation rates were less than 7(mg/cm²-yr¹) from 1877 through the early 1950s with a noticeable increase beginning after 1950 (>20 mg/cm²-yr¹ by 1980). The sediment accumulation rates continued to increase until the 1990s when values reached approximately 30(mg/cm²-yr¹), in the upper layers of the core. This increasing trend continued during the recent decade with levels averaging over 45(mg/cm²-yr¹). The positive change in sediment accumulation rate is a result of increases in organic matter from primary productivity and not inorganic deposition.

The down-core (12-20cm), C/N (17.35$_{AVG}$), are closer to values derived for combination s of seagrass-mangrove sediment values, but with the lower $\delta^{13}C^0/_{00}$ (-21.77$_{AVG}$) indicating less influence from mangrove material (*bulk avg:. -25.0 to -31.0 δ^{13}C). This was unexpected due to the physical dominance / presence of the mangrove community that surrounds Dove Lake. A shift in lower C/N values (11.56$_{AVG}$), from 1920 to present, shows a continuous transition for the origin of the sedimentary organic material that is more representative of algal sources, which can explain some of the variation in the $^{\delta 13}$C expected values.

Pigmentation results show that starting in the 1920s, and continuing up-core, there is evidence for major increases in productivity which is indicated by the upward shift in mass concentrations of the *B-car* and *Chlor-a*. This is also supported by an increasing *Pheo-a* (acting as a secondary indicator), and by the C/N shift seen in the 1920s. There are minimal decadal changes in the concentrations of *Myxo*, *Ech*, and *Canth*, (all used as measures for of *Cyanobacteria*), which reduce the potential for this to be an influence as the primary source for the organic algal material. Increases in *Fuco* and *Zea-lut* pigments, provide strong evidence for the organic productivity being derived from macrophyte and epiphytic diatoms. Therefore, evidence points to the initial origins of organic material being derived from a composition of sea grass and mangroves, but an ecologic shift has taken place (circa 1920) that has allowed the epibenthic diatoms to dominate the organics in the increasing mass sedimentation rate. The potential with positive nutrient loading, is for the system to continue to shift and perhaps become more susceptible / dominated by cyanobacterial blooms that are harmful to fish and indigenous plant communities.

Acknowledgements

✓*C/N v. δ^{13}C data from Carole McIvor, USGS: 2 mangrove forest sites along Shark River, ENP, FL (These C/N v δ^{13}C , values are also supported by investigations from Steve Bouillon, Alfred N.N. Muzuka, Philip A. Meyers, and H. Kennedy).

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