sandycay DEVELOPMENT LTD

Calcean
Renewable I Biogenic

# Sandy Cay & Calcean Presentation

Leading to a more sustainable world | 2020

Oolitic Aragonite: A Holistic Solution to Nutrient Pollution

# 2 Company

**Sandy Cay & Calcean were founded by** Anthony Myers, lease holder of the oolitic aragonite (calcium carbonate) deposits in the Bahamas.

**Operations:** The Bahamas is home to our exclusive oolitic aragonite harvesting operation. Our grinding operation takes place in Gadsden, AL and our future plastics compounding will also be performed in Gadsden, AL.

**Mission:**
**Sandy Cay & Calcean's core value:** Create products in the spirit of biogenic renewability, and be competitive on price. We recognize the volatility of commodity markets, and in order to compete on pricing, quality and performance must not be compromised.

# 3 What is Oolitic Aragonite?

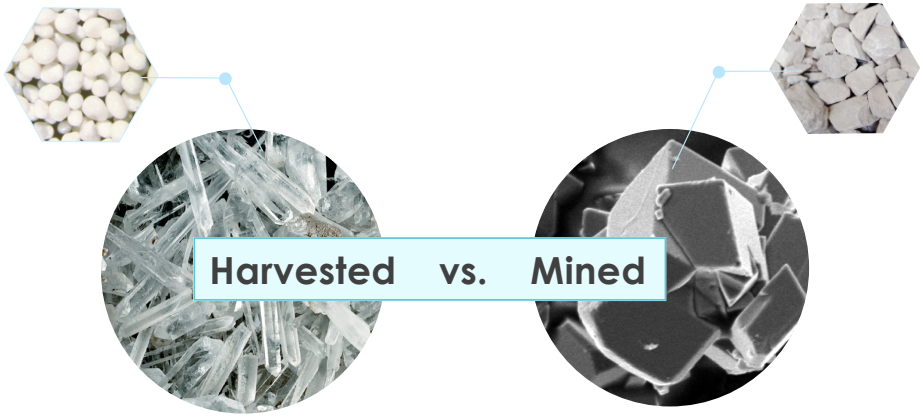
Oolitic aragonite sand is one of the **world purest forms** of the ocean's naturally precipitated calcium carbonate.

**Raw, naturally renewable oolitic aragonite sand is 92-98% pure calcium carbonate.**

This biogenic mineral is exclusive to the Bahamas.


The grains are oolitic (egg-shaped), smooth, and near white in color. It is tasteless, odorless, dustless, non-toxic and easy to handle.

# 4 Physical Properties Comparison




| | Oolitic Aragonite | Calcite / limestone |
|---|---|---|
| Specific Gravity | 2.8 – 3.0 | 2.6 – 2.8 |
| Mohs Hardness | 3.5 – 4.0 | 3.0 |
| Crystal Structure | orthorhombic | Trigonal |
| Surface Area | >1.82 m2/g | <.55 m2/g |
| Zeta Potential | -33.85mV to -6.65mV | -1.01mV to +11.55mV |
| Crystallinity | high | low |
| Microporosity | Very high | low |

Although calcite/limestone and oolitic aragonite have the same chemical formula ($CaCO_3$), each belongs to a different crystal system (morphology) and each has different physical properties.

# 5 Oolitic Aragonite Deposits

Oolitic aragonite (biogenic $CaCO_3$) naturally precipitates in the Bahamas.

## Harvesting Operation – Aragonite Banks

Ocean Cay owns the proprietary harvesting rights to oolitic aragonite. The harvesting operation is over 400 sq miles.

| | **Ocean Cay** Lease Area | **Bahamas Banks** estimated |
|---|---|---|
| Current Reserves | **1 to 2 Billion** Metric Tons | **50 to 100 Billion** Metric Tons |
| Annual Renewal Rate | **266,000 to 2,310,000** mts/yr | **14 to 120 Million** mts/yr |

# 6 Formation of Oolitic Aragonite

**The formation of oolitic aragonite (biogenic $CaCO_3$)** occurs as a phenomenon described as a "Whitings" event. The Whitings are an accumulation of precipitated calcium carbonate induced by photosynthesis, occurring in blooms of phytoplankton, which seasonally enter the warm shallow waters of the Bahamas.

**Carbon Sequestration:** During its formation, oolitic aragonite sequesters tens of thousands of tons of $CO_2$ from the atmosphere per year.

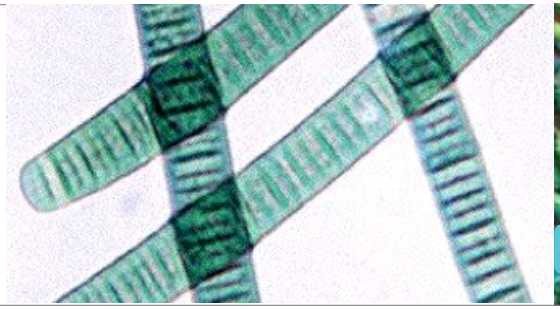
**Environmentally Harvested:** Our harvesting process from the oolitic shoals safely collects oolitic aragonite and promotes sea life habitation.

**Sustainable & Renewable Resource:** Whitings continually replenish through the carbon sequestration process, naturally producing reoccurring deposits of oolitic aragonite, annually. The **USDA confirms oolitic aragonite as a renewable resource, as proven through carbon dating.**

# Sustainability: Carbon Sequestration

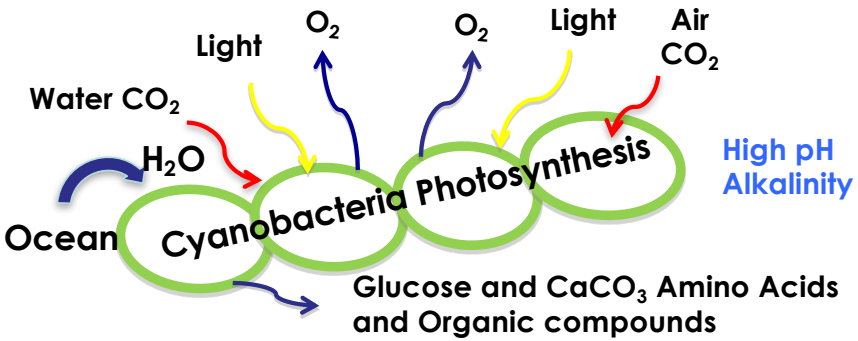
**The biogenic nature of this unique mineral not only improves the environment through its ability to naturally renew, but it also sequesters $CO_2$ from the atmosphere.**

Oolitic Aragonite is generated through the mineralization of Carbon Dioxide ($CO_2$) to Calcium Carbonate ($CaCO_3$) within natural occurring Blooms of phytoplankton, further picoplankton: specifically Cyanobacteria and unicellular blue-green algae.




**Photosynthesis drives the engine of both forms of carbon sequestration by cyanobacteria:**

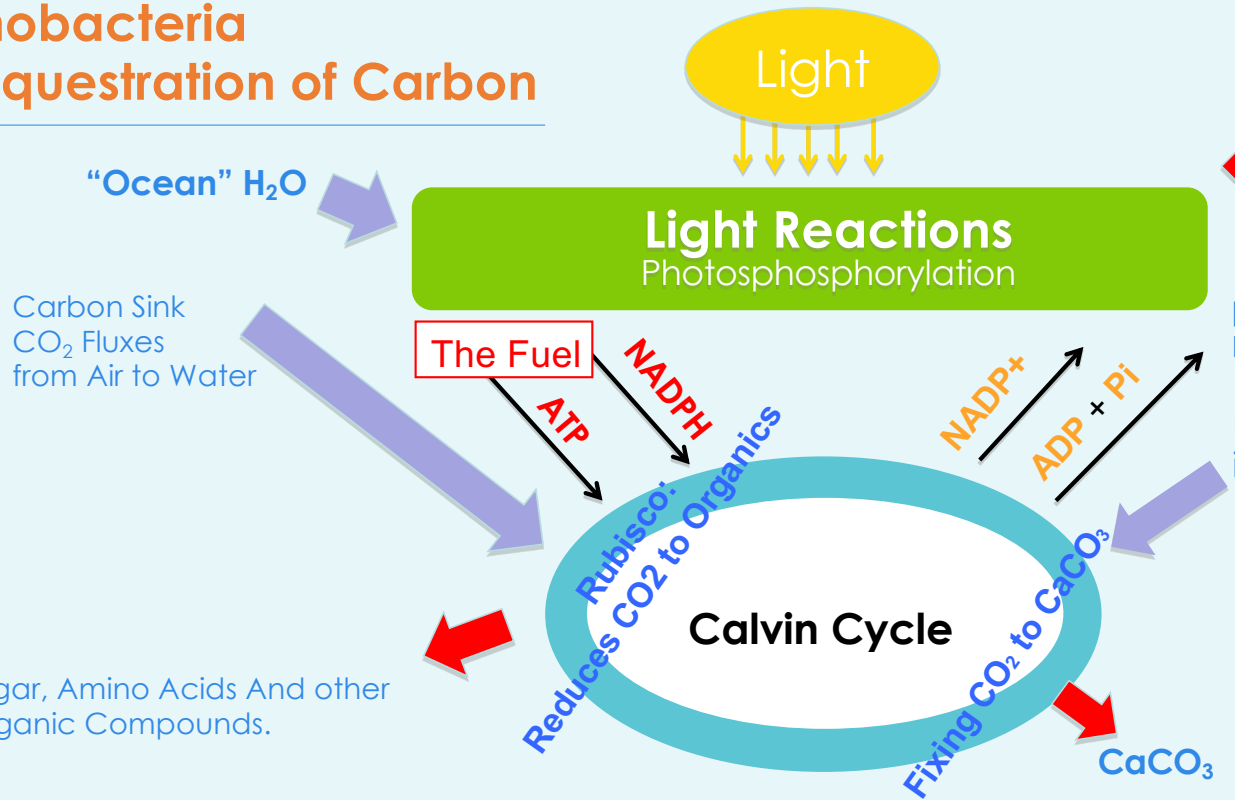
1. Reducing $CO_2$ to organic compounds at the same time producing Oxygen ($O_2$) through the Calvin-Benson-Bassham cycle.
2. Mineralizing $CO_2$ to recalcitrant carbonates; Calcium Carbonate ($CaCO_3$).



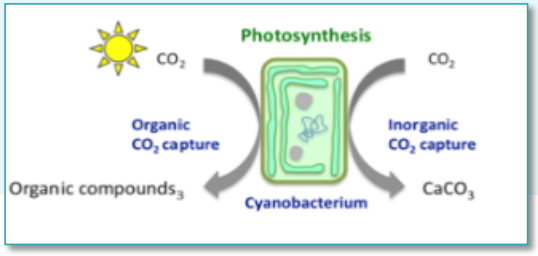

Kamennaya, Ajo-Franklin, Northen and Jansson; October 2012; "Cyanobacteria as Biocatalysts for Carbon Mineralization"

# 8 Sustainability: Carbon Sequestration Cont.

## Cyanobacteria Biosequestration of Carbon




Dual Carbon Fixing



# 9 Sustainability: Renewable & Sustainable

## Renewable Resource

Within the Ocean Cay lease area, Whitings continually replenish through the carbon sequestration process, naturally producing approximately **2 million tons of oolitic aragonite each year.**

## Sustainable Mineral

Our current rate of consumption per month of oolitic aragonite is equal to **0.003% of the oolitic aragonite reserve and less than 10% of the renewing material.**

**Sustainable Benefit:**
Oolitic aragonite's **generation vastly exceeds its consumption,** making it truly sustainable.

# 10 Sandy Cay & Calcean's Green Products

SandyCal™
Renewable | Biogenic

**SANDYCAL**: Raw aragonite sand (screened and dried) provides a low-cost, high efficiency, and eco-friendly sand alternative.

OceanCal™
Renewable | Biogenic

**OCEANCAL**: Finely ground and coated, aragonite provides a competitive alternative for direct powder applications.

BioCal™
Renewable | Biogenic

**BIOCAL**: Compounded calcium carbonate masterbatches & compounded pellets are an efficient, green, and cost-effective resins for plastics applications.

# 11 SandyCal Market

SandyCal™
Renewable I Biogenic

=

**SandyCal™ sand** is raw, naturally renewable oolitic aragonite that is 92-98% pure calcium carbonate.

**Available Markets**

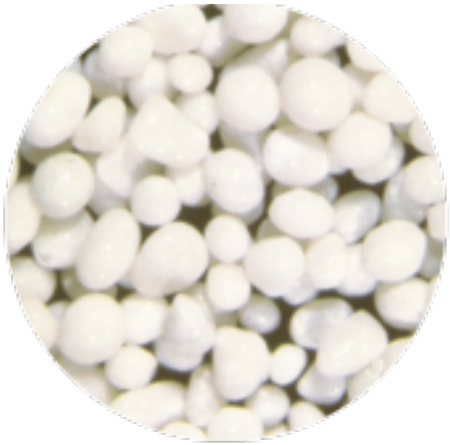
- ***Agricultural***
- Glass
- Construction
- Golf Course Plating Sand
- Beach Restoration
- Animal Feed
- ***Phosphate Mitigation***
- Aquaculture
- Power Plant $No_X$ and $SO_X$ Removal

# 12 Nutrient Pollution

- Nutrient pollution in waterways is caused by the run-off from agriculture
- Too many nutrients will feed algae creating harmful algae blooms (HAB), a hazardous problem for both humans and animals
- Important to find both a **preventative** and **remediating** measure to solve this problem, such as Oolitic Aragonite

# Oolitic Aragonite: A Holistic Solution

- Oolitic Aragonite:
  - has a **high surface area** and **high zeta potential**, which means it readily adsorbs nutrients like phosphates, nitrates, and nitrites
  - adsorbs double the amount of nutrients than calcite
  - performs just as well in waterways of any salinity
  - can act as both a preventative measure and remediating measure



# 14 Oolitic Aragonite: A Preventative Measure

- Oolitic Aragonite is a beneficial additive to agriculture
  - Controls pH
  - Makes plants more resistant to harsh conditions like drought
  - Promotes a healthy microbial community
  - Efficient source of calcium for plants

- **Most importantly**, due to its high surface area and zeta potential, it readily adsorbs nutrients from fertilizer
  - This means that it holds the nutrients in the soil where they belong preventing leaching into waterways
  - When used in agriculture, oolitic aragonite acts as a preventative measure for nutrient pollution

# 15 Oolitic Aragonite: Remediation

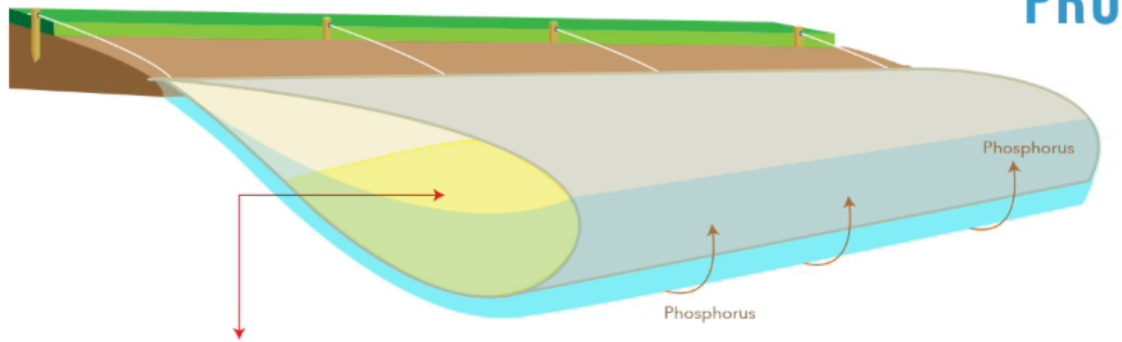
- Oolitic Aragonite can be used in several different ways to remediate contaminated waterways
  - Permeable bags filled with oolitic aragonite can be placed in areas where run-off is prevalent to capture the nutrients before they reach the waterways
  - Cap areas such as ponds where nutrient pollution is a problem
  - Place bags in waterways where nutrient pollution is seen

- An added benefit is that this nutrient saturated material can also then be applied to fields as a fertilizer
  - Creates a **usable** and **sellable** byproduct

- This idea won **Stage 1, Phase 2** of the **George Barley Water Prize**

# 16 Oolitic Aragonite: Remediation

AquaCal AgBag
PROCESS OVERVIEW




Phosphorus
& CaCO3

# Oolitic Aragonite: Other Benefits

- Oolitic aragonite can also neutralize ammonia

- When used as a bedding in chicken houses, the ammonia smell was significantly reduced
  - Another added benefit was that the black beetle problem diminished with the use of aragonite

# Oolitic Aragonite: Ammonia Neutralization

- Oolitic aragonite neutralizes ammonia and these effects can be seen in a variety of applications
  - Chicken Houses
  - Infill
  - Litter
  - Pig Farms

- Research results indicates aragonite has the best ammonia neutralization capabilities

# Adsorptive Benefits: Summary

Nutrient Pollution Prevention and Remediation

High surface area and microporosity mean that aragonite is unsurpassed in its adsorptive capabilities. The high surface area allows a bio-load many times greater than other substrates.

- Readily adsorbs phosphates and nutrients
- Retains nutrients, preventing leaching into waterways
- Can be both a preventative measure and remediating measure in nutrient pollution from run-off
- Better for crops, better for the environment

# Agricultural Benefits

| | |
|---|---|
| **Extremely High Surface Area** | 1.7 square meters per gram (20,000 square inches per cubic inch) which means the maximum area for binding locations for the development of a microbial community required for healthy plant growth |
| **pH Buffer** | Maintains stable pH especially with the addition of nitrogen, ammonia and phosphorus fertilizers |
| **Adsorbs Phosphorus** | This means there is longer continued efficient use of the fertilizer for the plant root |
| **Efficient Source of Calcium** | One ton of aragonite will deliver 28% more calcium than a ton of anhydrous gypsum and 60% more calcium than a ton of hydrated gypsum |

# 21 Agricultural Benefits

| | |
|---|---|
| **High Sphericity and Microporosity** | Traps moisture but still allows hydraulic conductivity and will not limit air flow through the substrate. Entrained moisture is accessible during dry periods and stabilizes soil temperatures. |
| **Ease in Spreading** | No outdoor covering required and spreads easy both wet and dry, with little to no dust. |
| **Increased Hydraulic Activity** | Ksat values measured in the 50 plus in/hr indicating excellent drainage capabilities. |
| **Sequesters Suspended Sediment & Nutrients** | Sequesters suspended sediment and nutrients in farm, golf course, and lawn water runoff, which limits the environmental impact on surrounding natural areas, especially when located next to sensitive habitats. |

# 22 Agricultural Benefits

**Promotes Healthy Microbial Communities**

In the 1970's, Amish and Mennonite farming communities that began to use aragonite in their row crops and alfalfa production noticed that there was a noticeable reduction in loss of their crops due to nematodes.

This is likely due to the presence of chitin in aragonite, which is a known component in the reduction of nematodes due to a bacteria that utilizes it as a food source. Chitin is also present in the egg matter of nematodes, a primary food source for this type of bacteria. If chitin is already available in the soil from the aragonite, a healthy community of bacteria will already be present and ready to consume the next generation of nematodes.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