Assessment of Marine Sand Resources and Economic Heavy Minerals on Virginia’s Outer Continental Shelf

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Hurricane Sandy

- **Jan 2013** – BOEM received $13.6 million for coastal resiliency studies and sand resource evaluation from Federal Disaster Relief Appropriations Act
- **April 2014** – 13 cooperative agreements with state geological surveys
- **2015** - BOEM awarded $5 million contract to CB&I to conduct Atlantic Sand Assessment Project, 3-8 nautical mile strip from Maine to Florida.
Purpose of Study

- Determine the quality and volume of sand resources in 2 study areas
  - Wallops Island
  - Sandbridge Beach
- Heavy Mineral Analysis
- Synthesize existing and newly available offshore Geodata
Project Location area 3-8 nautical miles offshore
What is Beach Quality Sand?
Beach Quality Sand for VA

- Wallops Island, VA
  - Sand: poorly or well sorted
  - Containing no more than 10% fines passing through a #200 sieve (0.074 mm)

- Sandbridge, VA
  - 50% greater than .2 mm, preference is .25 mm
  - Color does not matter

- Client specification
  - Low shell content
  - Low rock content
  - Low iron-oxide
Beach Nourishment

Wallops Beach Restoration

Before

After

North View

North View

http://www.climatetechwiki.org/content/beach-nourishment

https://www.nasa.gov/centers/wallops/news/beach.html
How do we find beach-quality sand?

- Offshore geologic correlation and interpretation (where there is a sufficient amount of data)
Ancient Beach Sands

- Iluka Resources has mined Pliocene beach sands since early 1990s; estimated $2.5 billion in zircon and ilmenite
Mineral Exploration Offshore

**Minerals**

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Garnar, 1978</th>
<th>Iluka Resources Old Hickory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ilmenite - FeTiO$_3$</td>
<td>(45%)</td>
<td>(54-68%)</td>
</tr>
<tr>
<td>Leucoxene - alteration product of FeTiO$_3$</td>
<td>(5%)</td>
<td>(1-2%)</td>
</tr>
<tr>
<td>Rutile - TiO$_2$</td>
<td>(2%)</td>
<td>(1-3%)</td>
</tr>
<tr>
<td>Zircon - ZrSiO$_4$</td>
<td>(5%)</td>
<td>(15-21%)</td>
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<tr>
<td></td>
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<td></td>
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<tr>
<td>Monazite - (Ce,La,Nd,Y,Th,U)PO$_4$</td>
<td>(1%)</td>
<td></td>
</tr>
<tr>
<td>Staurolite - (Fe,Mg,Zn)$_2$Al$_9$Si$<em>4$O$</em>{23}$(OH)</td>
<td>(20%)</td>
<td></td>
</tr>
<tr>
<td>Sillimanite group minerals - Al$_2$SiO$_5$</td>
<td>(7%)</td>
<td></td>
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THM in many samples exceed the 2% economic threshold

- Red > 10%
- Yellow > 5% < 10%
- Green >2% < 5%
Spiraling Heavy Mineral Concentrate
Geologic Framework

- Update our understanding of the Quaternary-Neogene geologic history of Virginia’s Continental Shelf (VA-NC state line to Smith Island Shoals)
- Use Zircon to determine sediment provenance
- Examine OCS heavy mineral composition differences that may result in these successive paleochannels

Figure 15 from “Atlantic Coastal and Inner Shelf”. The Geology of Virginia
Acknowledgements:

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Work Cited