The Bahamas use of deep wells for effluent disposal and as a source of seawater usable for multi-purposes

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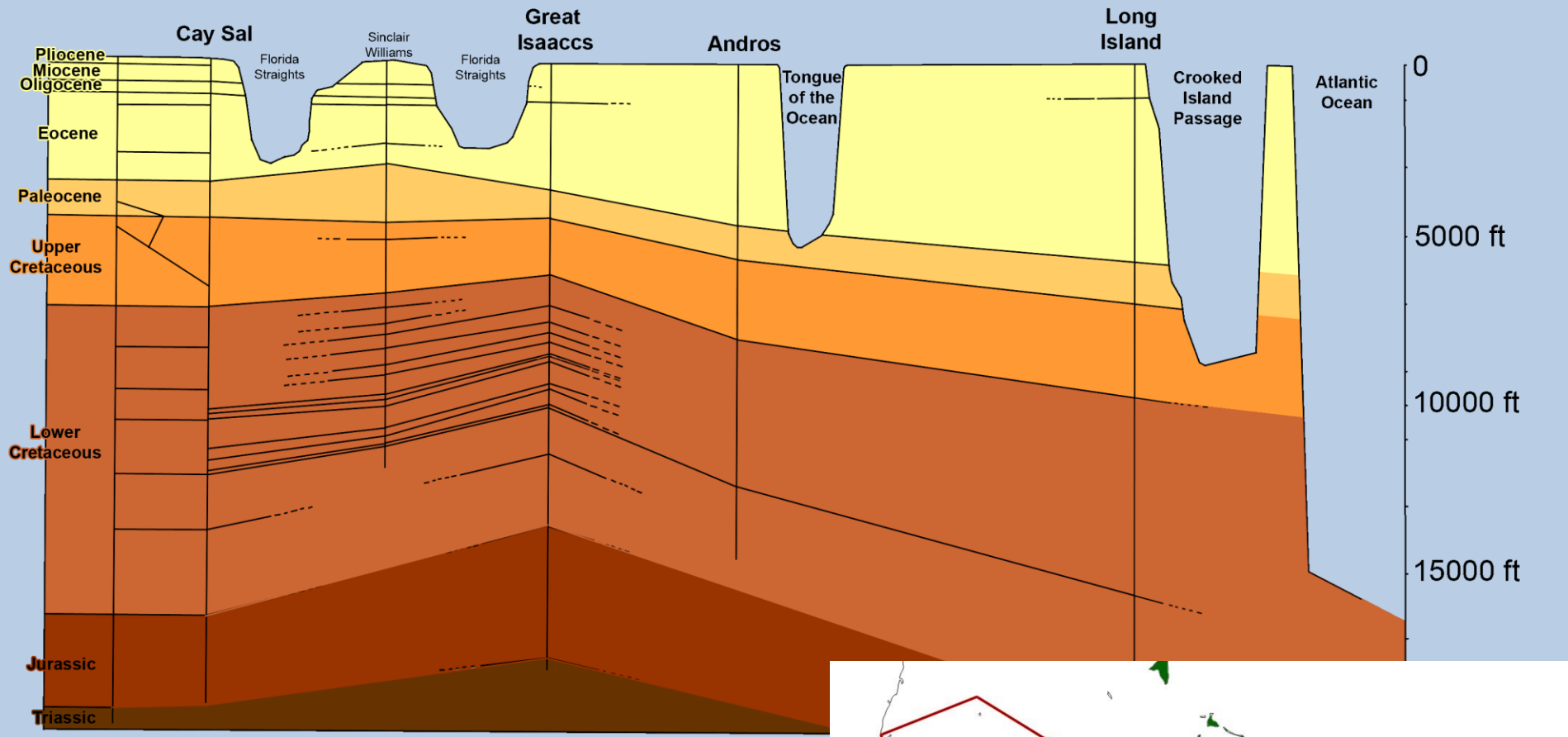
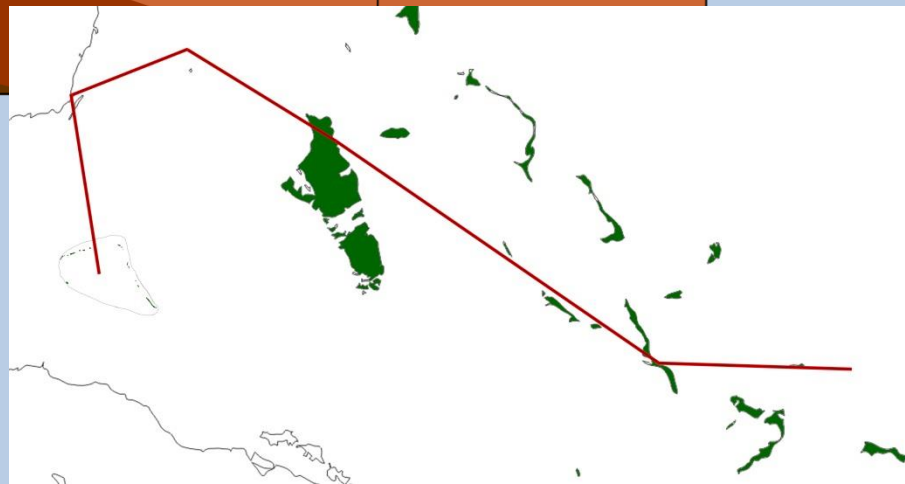
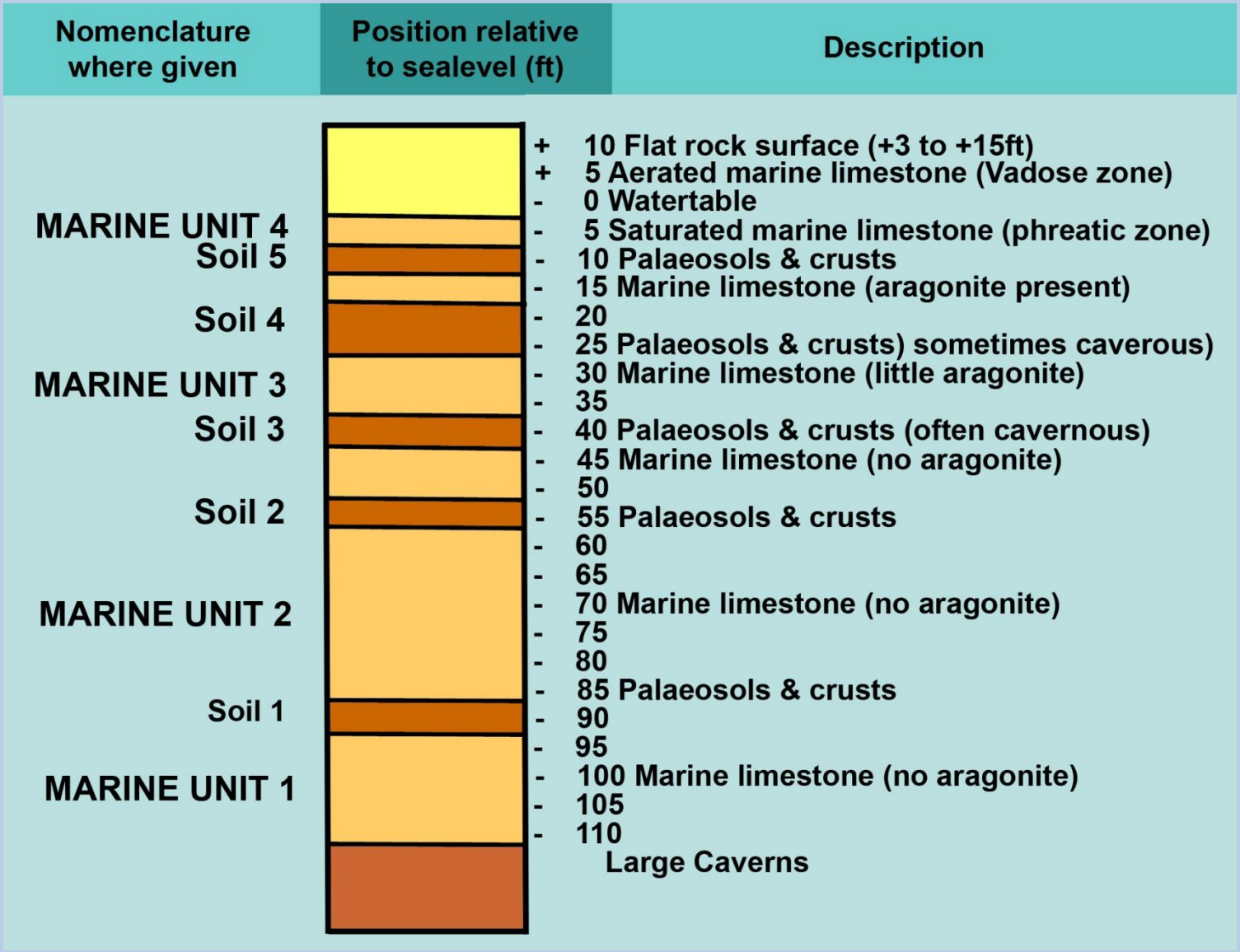
Hydrogeologist

Geologic cross-section of Florida – Bahamas

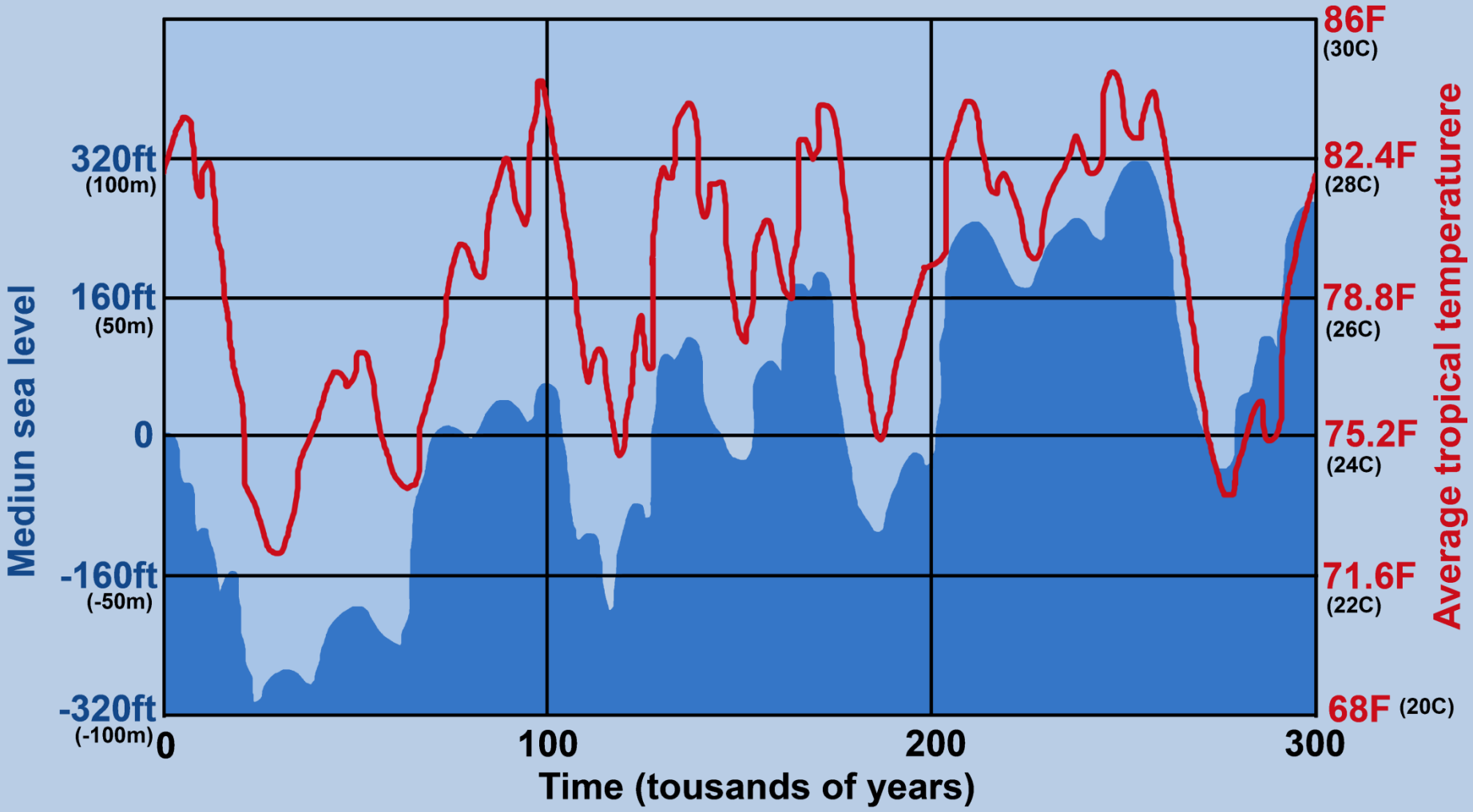




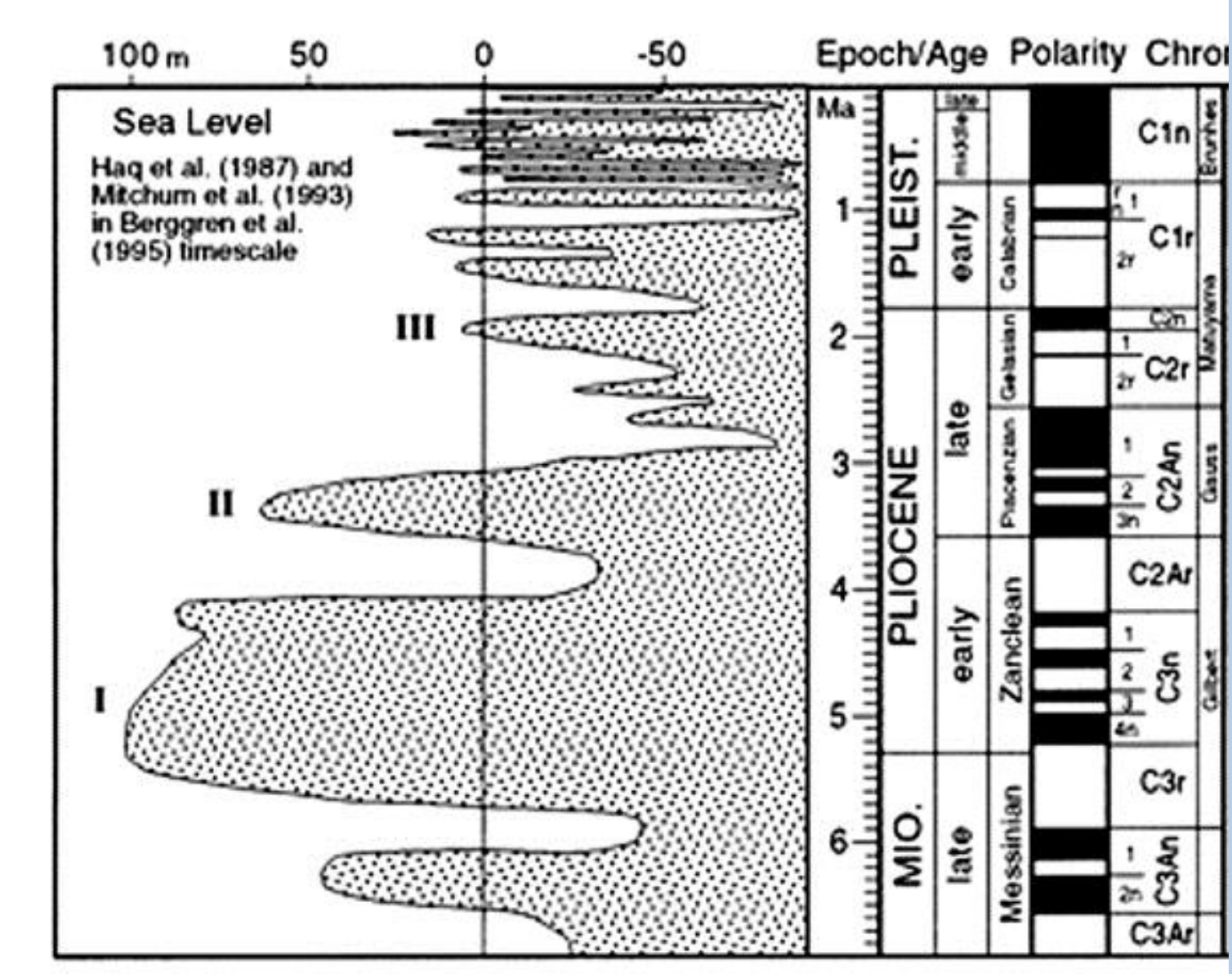
Generalized geological section of uppermost 110 ft of The Bahamas



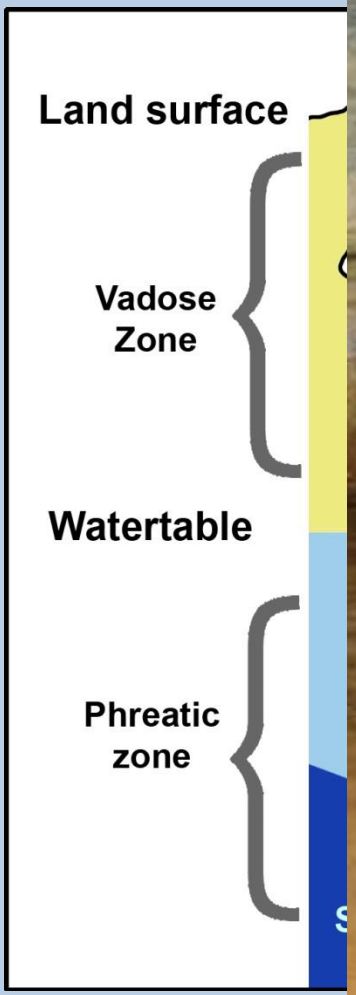
Sequence of Pleistocene sea levels

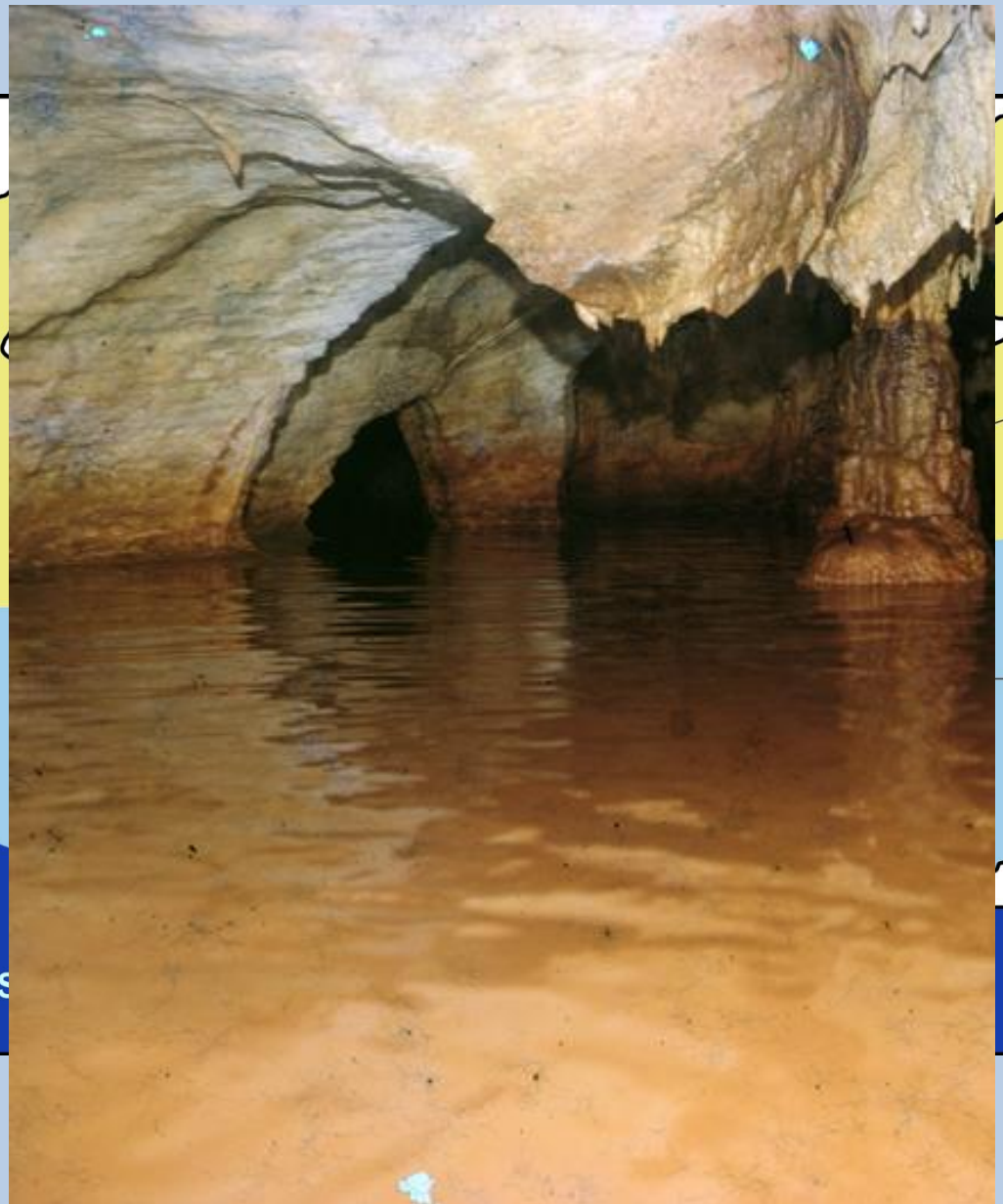


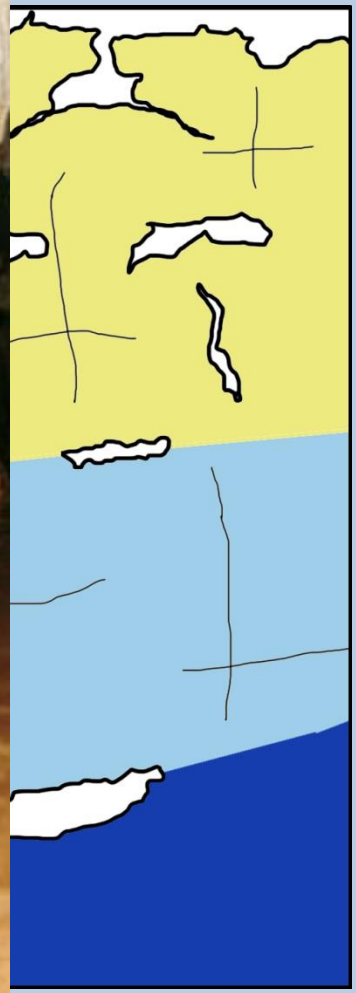
Sequence of Pleistocene sea levels



Carbonate solution system development







Options available for disposing of treated waste effluents

Dilution in lakes and rivers

Reuse

Sea outfalls

Deep wells

Various types of effluents to be disposed

Run off and storm water

Treated sewage

Industrial wastes

Desalination brines

Water used for cooling purposes

Zoning the subsurface to protect resources and identify disposal zones.

Water resources protection zone. Typically all of the Lucayan Limestone.

Site specific needs

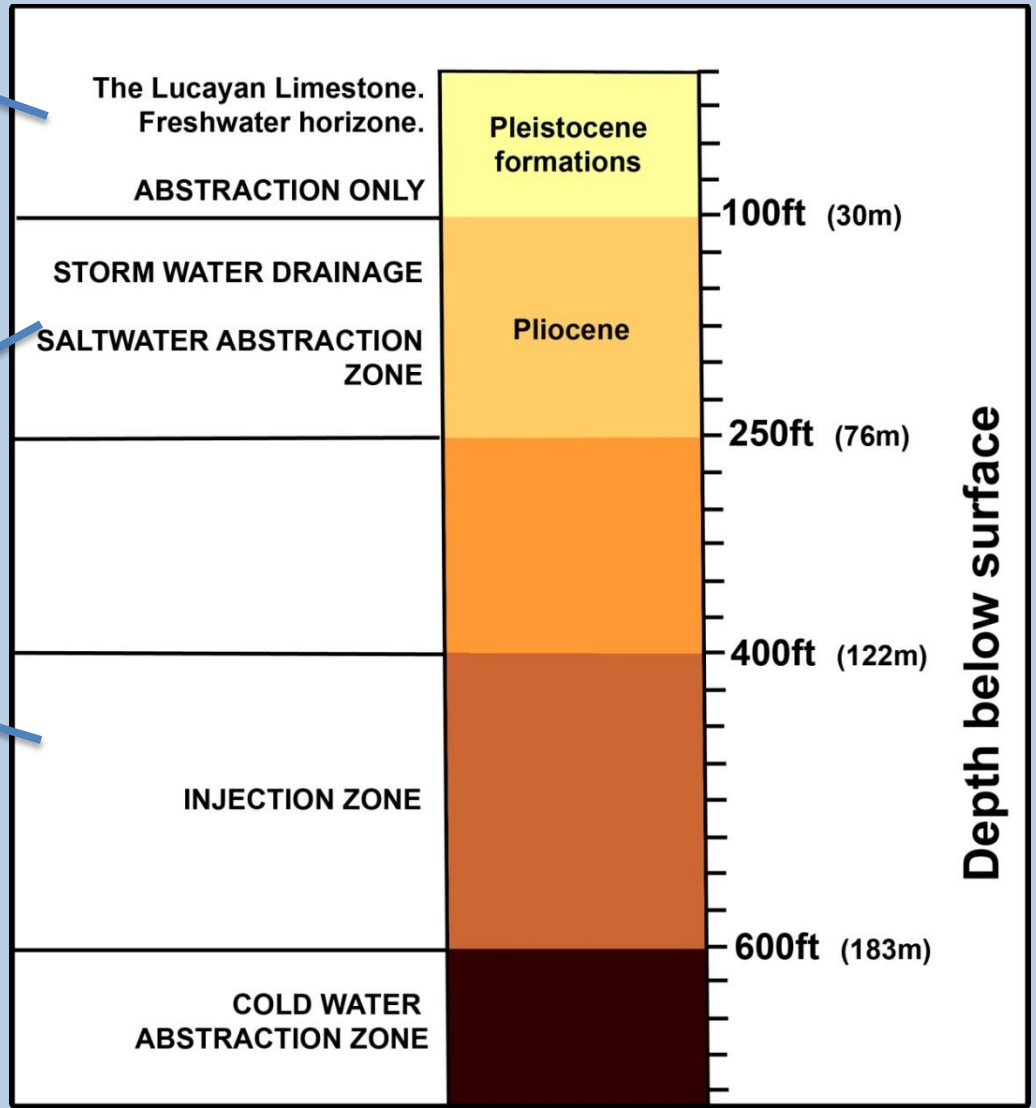
Saltwater supply source horizons, e.g. water needed for desalination.

Aquicludes

Bluenoles

Small scale effluent disposal, e.g. septic tank effluents etc.

Larger volumes of effluent disposal.



Logs and well testing procedures required to set appropriate standards and specifications for use of deep wells

Pilot well and well log

Geophysical logs

Pumping tests

Casings and casing depths

Annulus and grout requirements etc

Present status of use of deep wells

Hundreds presently is use in many different islands

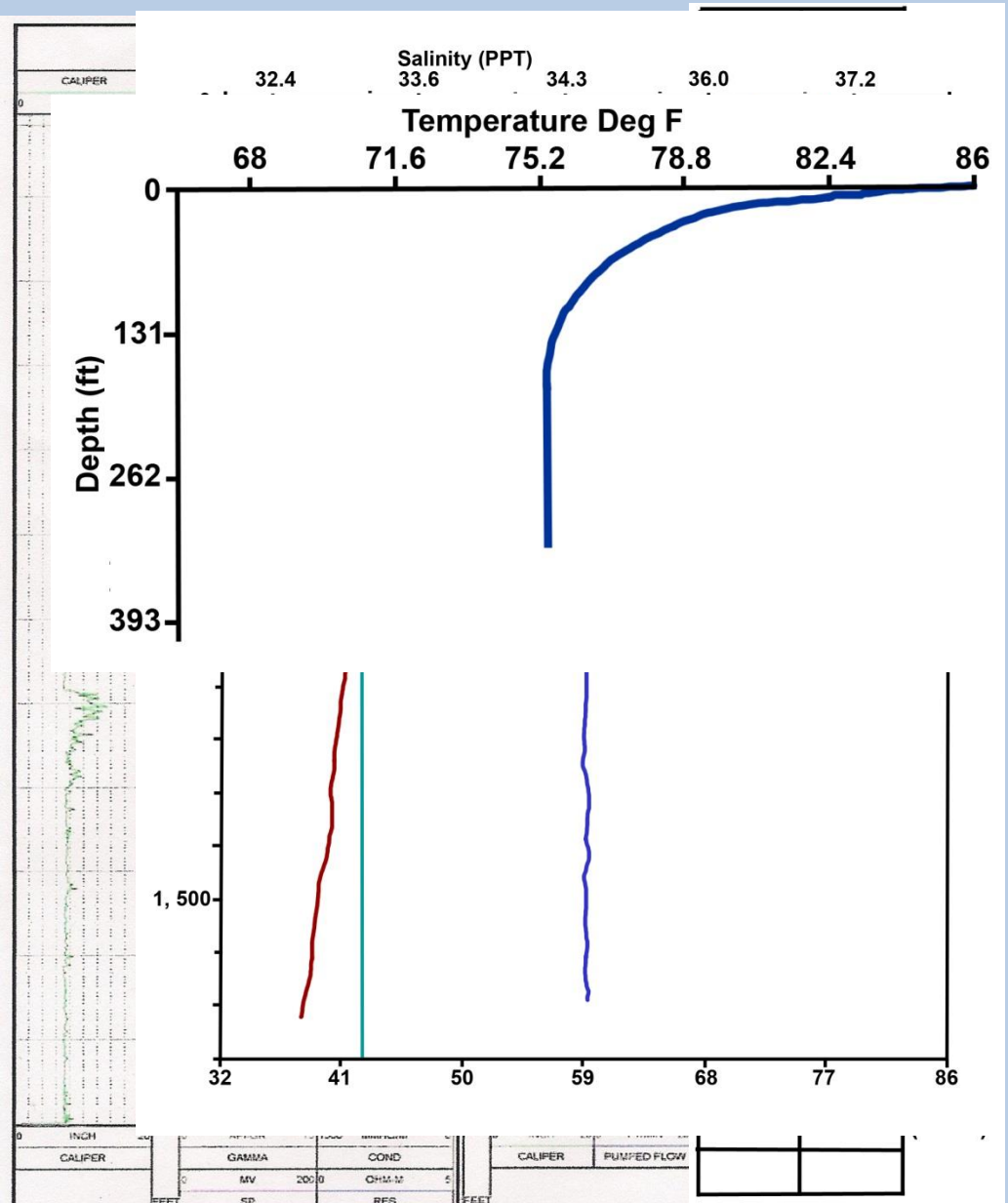
Up to 10 million g/d have been discharged via a single well

Some wells have been in use for over 40 years

Very few well failures reported

Failures result from improper installation procedures and use of poor quality casings

The reverse geothermal gradient (RGG)



In The Tropics of the Ocean

Potential beneficial uses of cold water from the subsurface

Mariculture operations.

Seawater District Cooling, and air conditioning.

Greenhouse irrigation.

Cooling water for motors and heavy equipment.

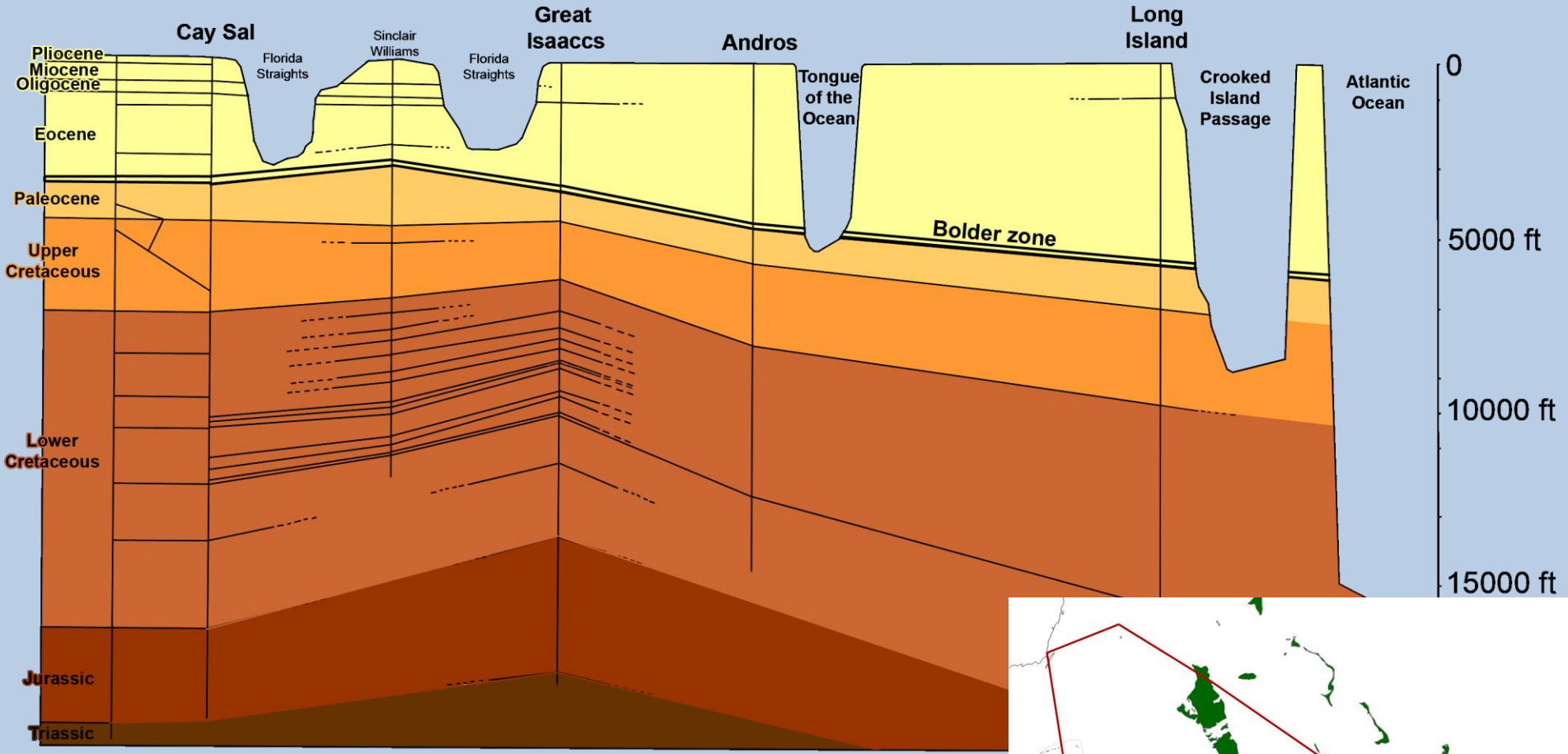
Use in Ocean Thermal Energy Conversion application.

What needs to be done ?

Deep exploratory wells and appropriate tests are needed to confirm RGG, and hydraulics.

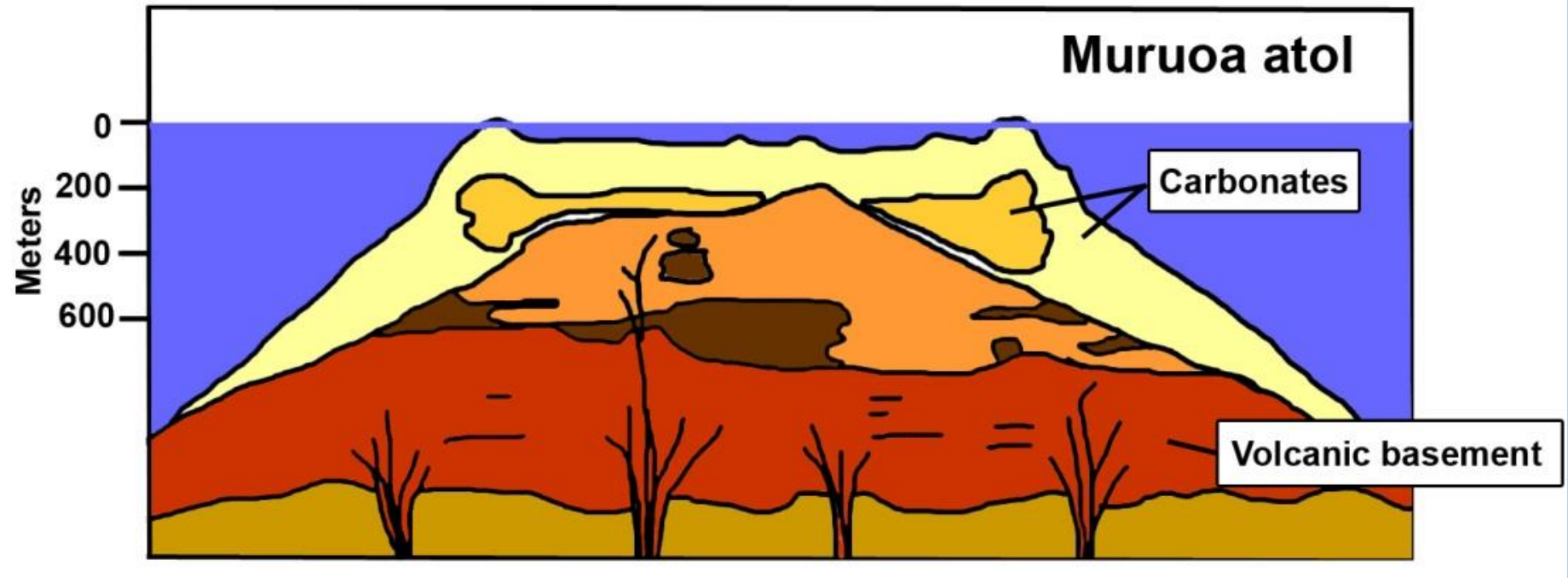
Can deep wells be used elsewhere?

1. South East Florida



Can deep wells be used elsewhere cont'd

2. Atolls and other small limestone islands



3. Continental geology

Relevance to Cartagena Convention

THE CARTAGENA CONVENTION AND PROTOCOLS

THE BAHAMAS WATER AND SEWERAGE CORPORATION'S

RECOMMENDED AMENDMENTS TO THE ACT AND PROTOCOLS.

THE ACT

Article 7 OF The Act

The Contracting Parties shall take all appropriate measures to prevent, reduce, and control pollution of the Convention area caused by coastal disposal or by surface or subsurface discharges emanating from rivers, estuaries, coastal establishments, outfall structures, disposal wells, or any other sources on their territories.

PROTOCOL CONCERNING POLLUTION FROM LAND-BASED SOURCES

Article 1 Definitions.

(d) "Land-based sources and activities" means those sources and activities causing pollution of the Convention area from coastal disposal or from discharges that emanate from rivers, estuaries, coastal establishments, outfall structures, disposal wells, or other sources on the territory of a Contracting Party including atmospheric deposition originating from sources located on its territory;

Annex 1 B

Include:

- Desalination Brines
- Heated Effluents

Annex 1 C

Include:

Brines

Annex 11 A. 3.

(f) Alternate disposal activities (for example, land application, and deep well disposal).

Annex 11 B. 2.

Location and type of the discharge (outfall, canal outlet, gullies, deep wells, etc.) and its relation to sensitive areas (such as horizons containing important groundwater resources, swimming areas,...

Annex 11 B. 3.

Initial dilution achieved at the point of discharge into the receiving surface or subsurface marine environment.

Annex 11 B. 4.

Dispersion and advection characteristics.....

Annex 11 B. 6.

Capacity of the receiving surface or subsurface marine environment....

Annex 111 A. 2.

(f) Waters in subsurface horizons deemed worthy of protection.

Annex 111 B. 1.

(b) To the extent practical, locate, design and construct domestic wastewater treatment facilities, outfalls, and effluent disposal systems, such that any.....

Any Questions?