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# Learning Objectives

At the end of this program, participants will be able to:

1. *(Discover the source of Lime used in Jeddah traditional architecture)*
2. *(Identify some traditional building materials and methods)*
3. *(Grasp the properties of Lime, Portland cement, Pozzolan )*
4. *(Appreciate the Green approach of Traditional Architecture)*

# THE RISE AND FALL OF THE CORAL WALL

Historical City of Jeddah  
in the making

By  
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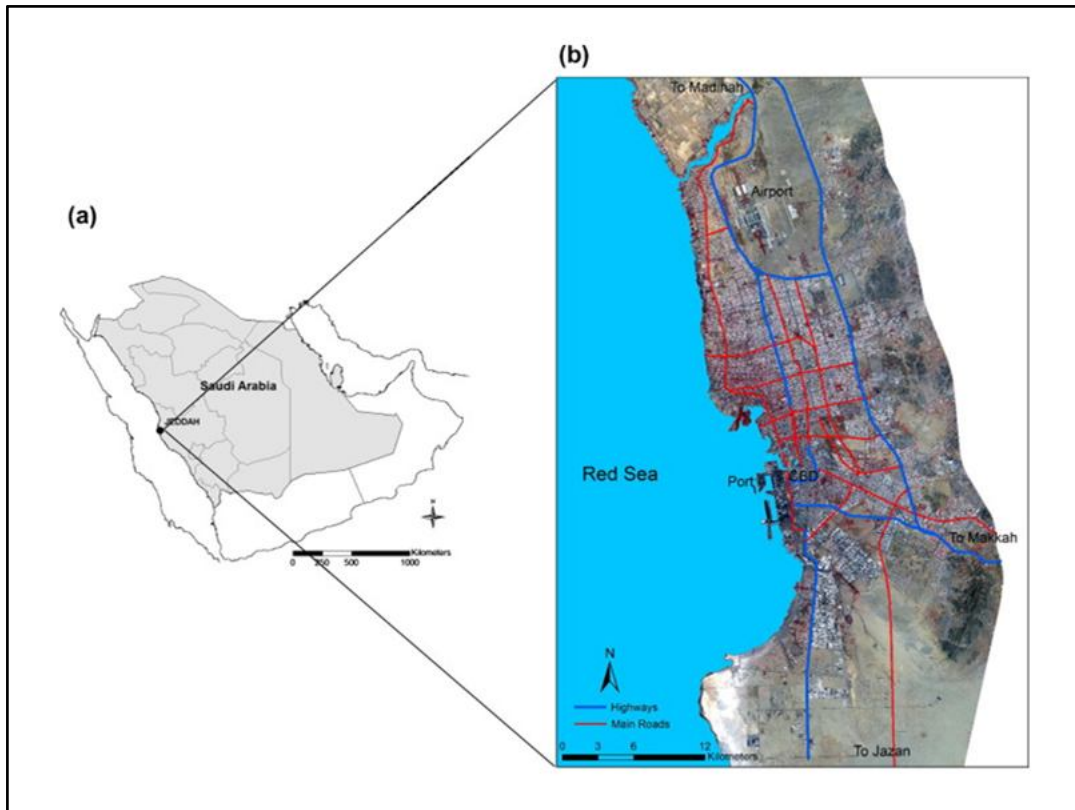
Ladies and gentlemen

My name is Mohammed Hussein Shukri

A Saudi Architect from Jeddah

The title of this presentation is

The Rise and Fall of the Coral wall



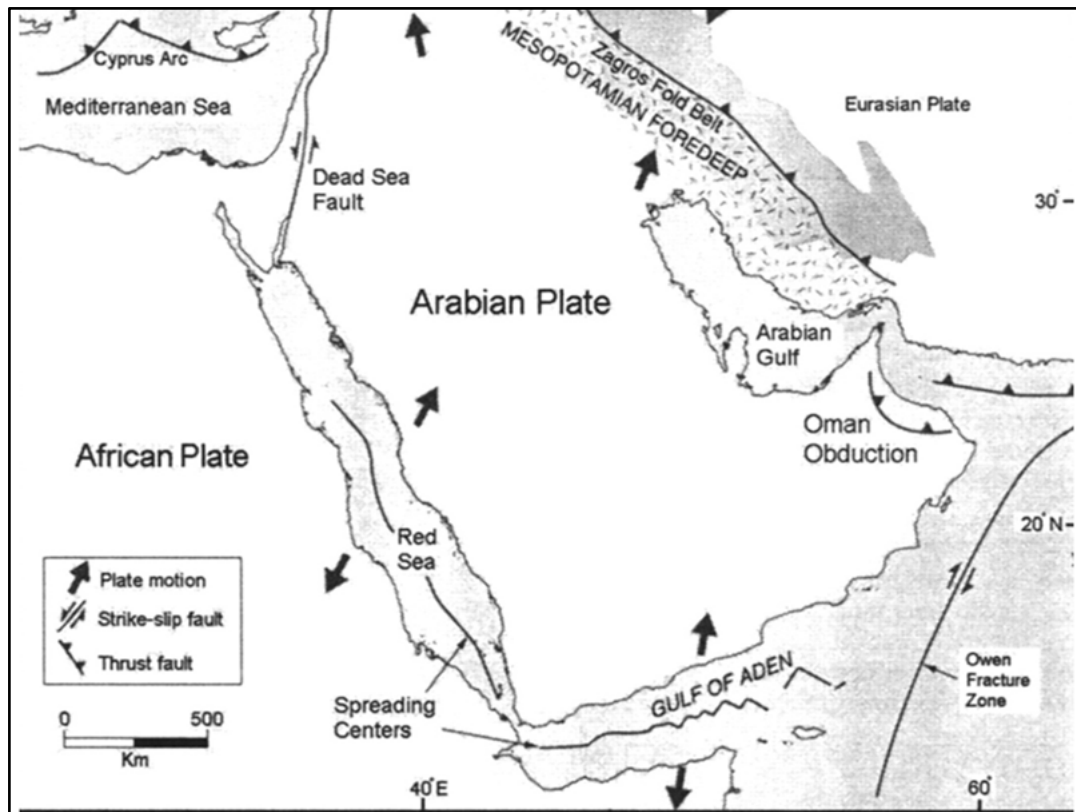
The subject coral wall, was chosen because **for centuries** "coral stone" **was the main building element of traditional architecture** of Jeddah.

from near the historic District of Jeddah,

**We will start a journey**

deep into **a fascinating universe,**

**will start from the coral reefs of the Red Sea.**



Over millions of years,

the seas reclaimed **due to the earth platonic movement** , and left us land with **sedimentary coral stone** that **once were living coral reefs**

**coral stone** was the **main component of buildings** that **stood up for centuries**

It is **still standing and willing to survive**

**The use of coral stone demonstrates how innovative traditional builders** were in **providing architectural solutions** to **survive and coexist** with nature



The message I want to deliver is that:

The historic district of Jeddah house some of the most

**Charming and unique**

**Innovative and simple architecture**

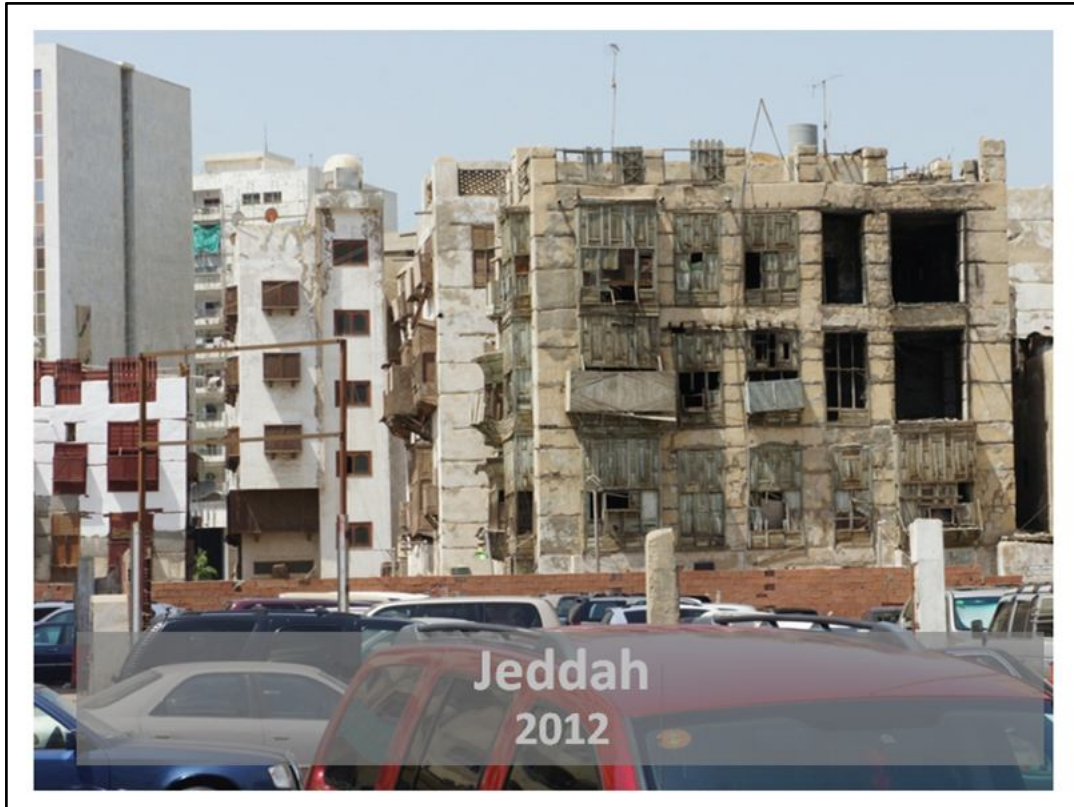
And it is

Rich in historical and cultural value as well

Yet

It is left to slowly deteriorate and diminish





**Thus, Efforts to preserve and restore are highly needed**

**Opportunities' to record and learn are endless**

That said

We can start this presentation by the **lessons learned from nature, in material properties, individual role, and collaboration effect**

Then we will get back to **how coral stone was used in the traditional Architecture of Jeddah**



## Protective Shelter, jewelry, and an animal



### **So what is coral?**

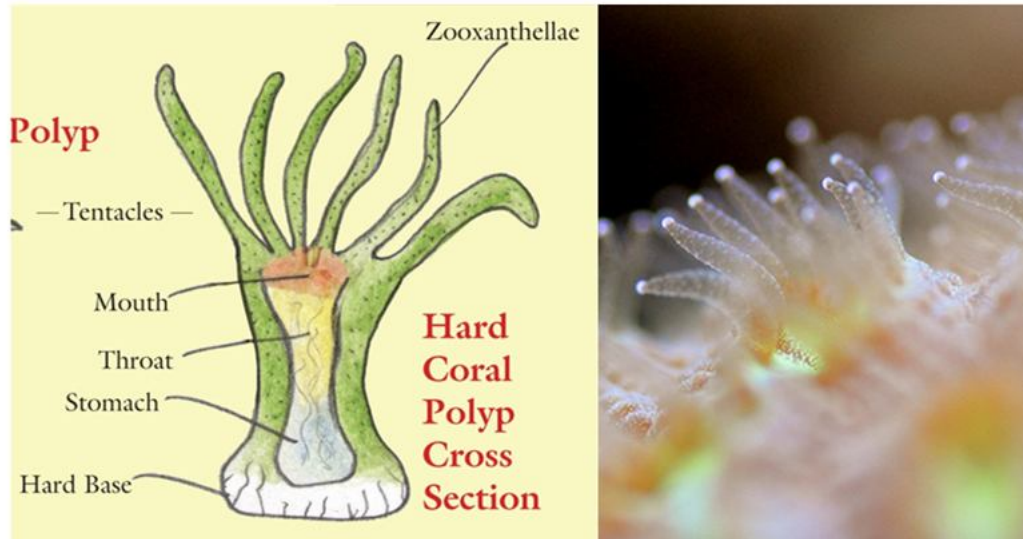
We might know coral as a precious stone used as **jewelry**

We have also seen some photos of the colorful underwater **reefs**,

Used by fish as a **protective shelter**, a house, a camouflage from predators.

fact is, **Coral itself is an animal.**

only a few millimeters in diameter, living in compact dense colonies



The given name for this **soft body, spineless, sea animal** is **polyp**,

Polyp is only a few millimeters in diameter,

normally living in compact dense [colonies](#),

it groups to build the grate reefs of the seas.

In fact, coral reefs are the biggest built structures in the world.

## Calcium Carbonate deposits



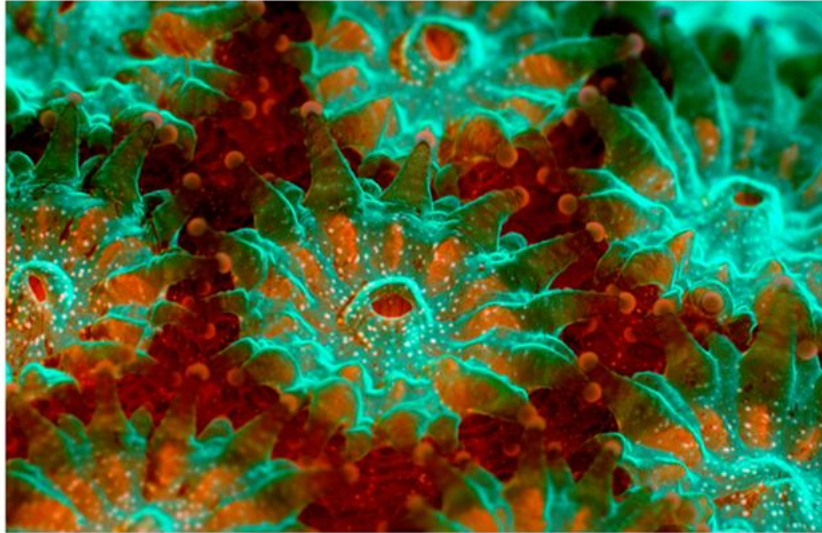
Coral exist in nature in **soft and hard** forms,

The **hard coral is our subject** in this presentation

Where the Polyp protects itself **by forming a hard shell of calcium carbonate deposits around its body;**

normally in white color and rarely in red or black tones

## beneficial symbiotic relationship with microscopic unicellular algae



polyps' feeds on microorganisms' such as plankton

Yet it has a mutually **beneficial symbiotic relationship with microscopic unicellular algae** called "zoo.xan.thellae" زوزان تلي

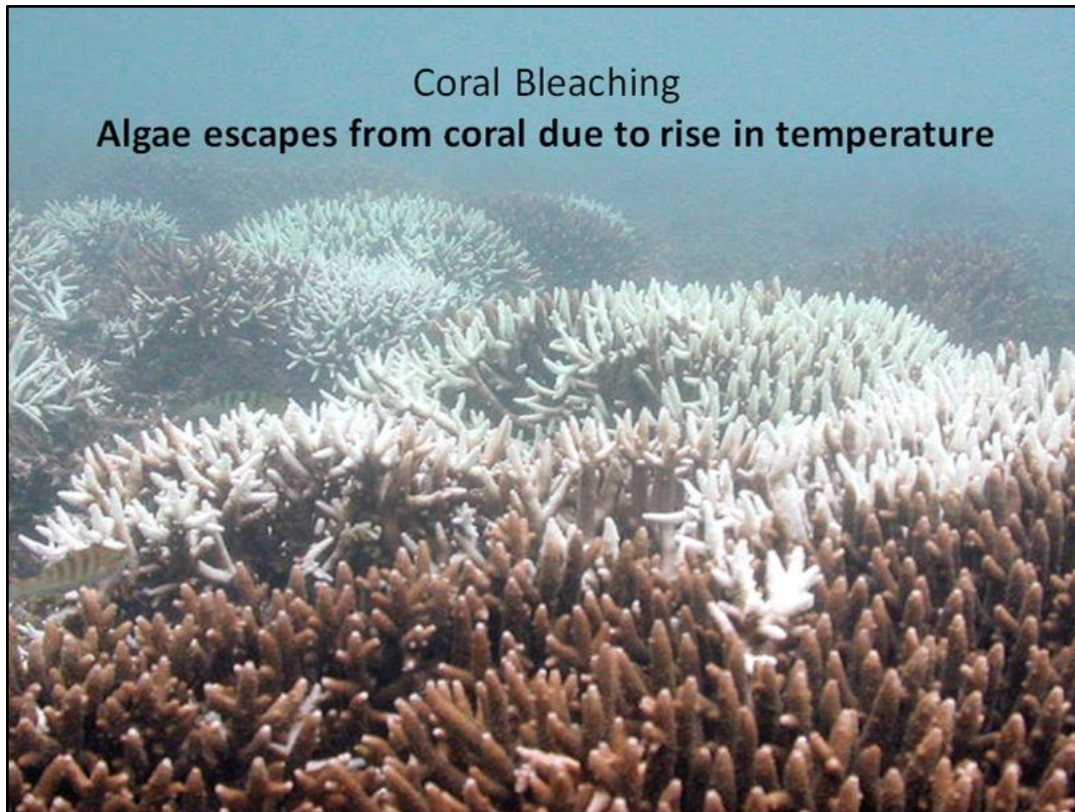
Without these plants, the coral animals will not be able to **obtain enough nutrients to build their skeletons,**

The **algae are invited to live inside** and finds a safe shelter  
the polyps gain energy, oxygen, and "carbohydrates" the organic products from the **algae's photosynthesis process.**

**The photosynthesis process means that in daylight the algae absorb CO<sub>2</sub> and release O<sub>2</sub> in the sea.**

**Very important process in Planet Earth sustainability**





The polyp itself also uses **CO<sub>2</sub>**, plus the energy generated **from the carbohydrates**, to build the **calcium carbonate** structure

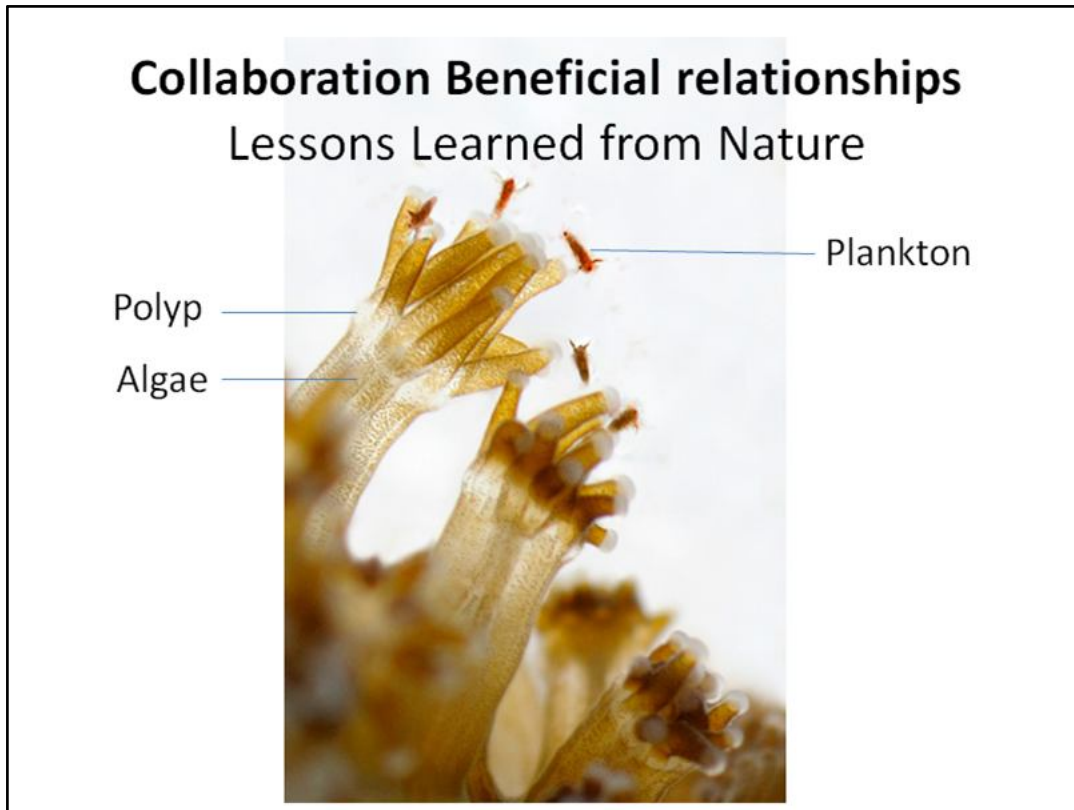
The algae gives living coral the green, yellow or orange tones

some times the **algae escapes and detaches itself from coral** due to Environmental changes,,

the coral skeleton stands alone with **no life** and no color,

a phenomenon known as **coral bleaching**.

**Dead Coral**



**in this, Nature** demonstrates the **importance of collaboration**

Without algae no polyp no life

We can see that no matter how small the individual effort is, consistency and collaboration lead to massive achievements.

**Beneficial relationships** are a must to survive, grow, and nourish.

It is the key to success ,

Today **one can say** that the **historic district** have similarities

**It is like a bleached coral, with few polyps trying to survive the environmental changes with less and less "plankton visitors"**

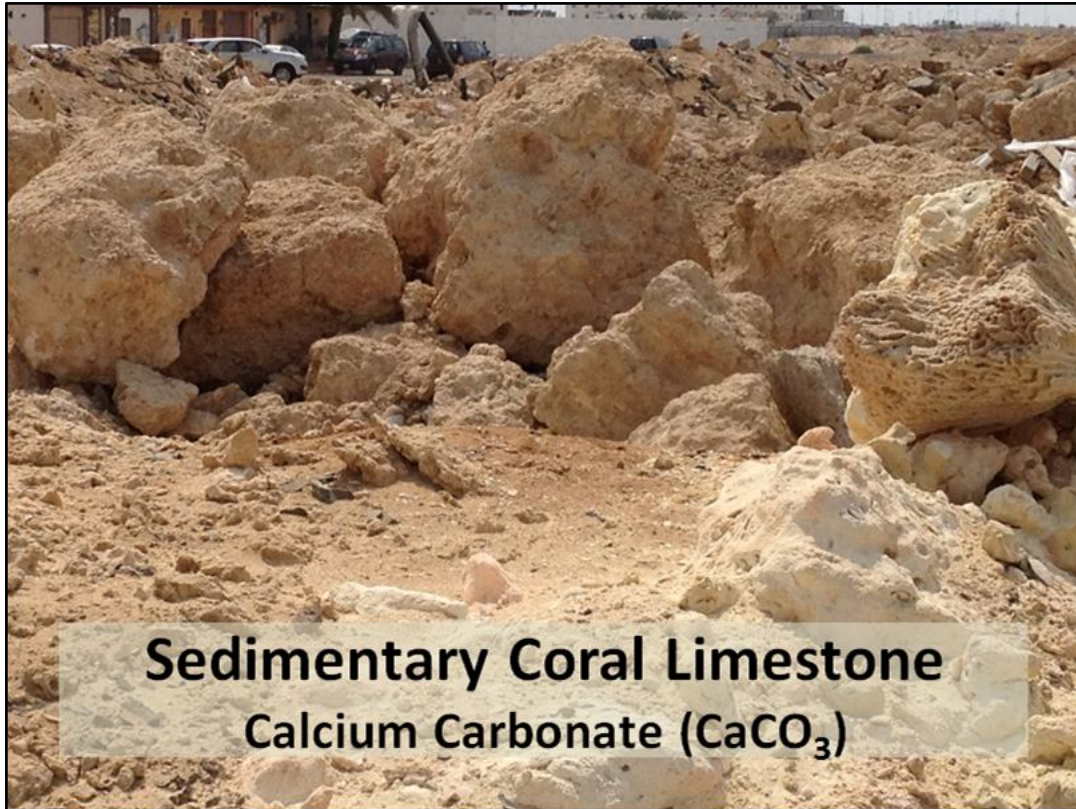


Today

we can find Coral stone in most excavated sites in Jeddah.

Question is: **Are we making use of it?**



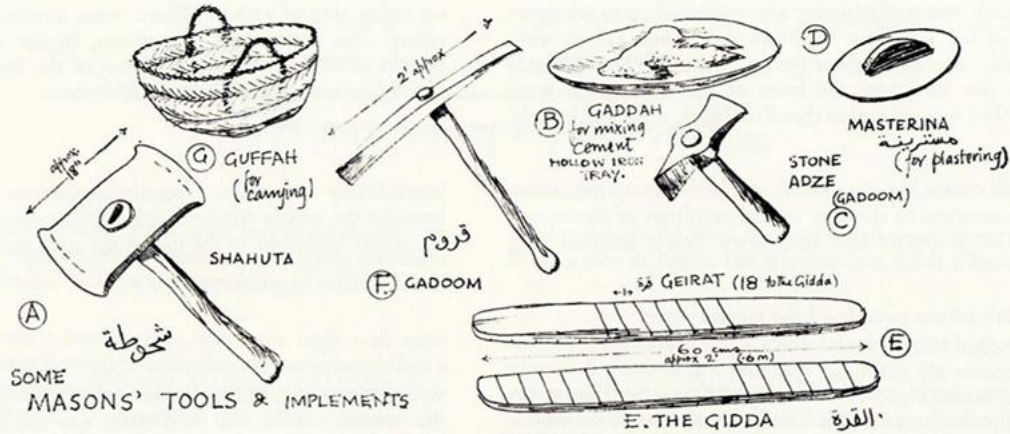


“Al Mangabi” Coral stone, as called in Jeddah, is a [sedimentary rock](#)

composed primarily of calcium carbonate (CaCO<sub>3</sub>)

It has formed from the accumulation of shell, coral, algal and fecal debris.

## Traditional building Methods and tools

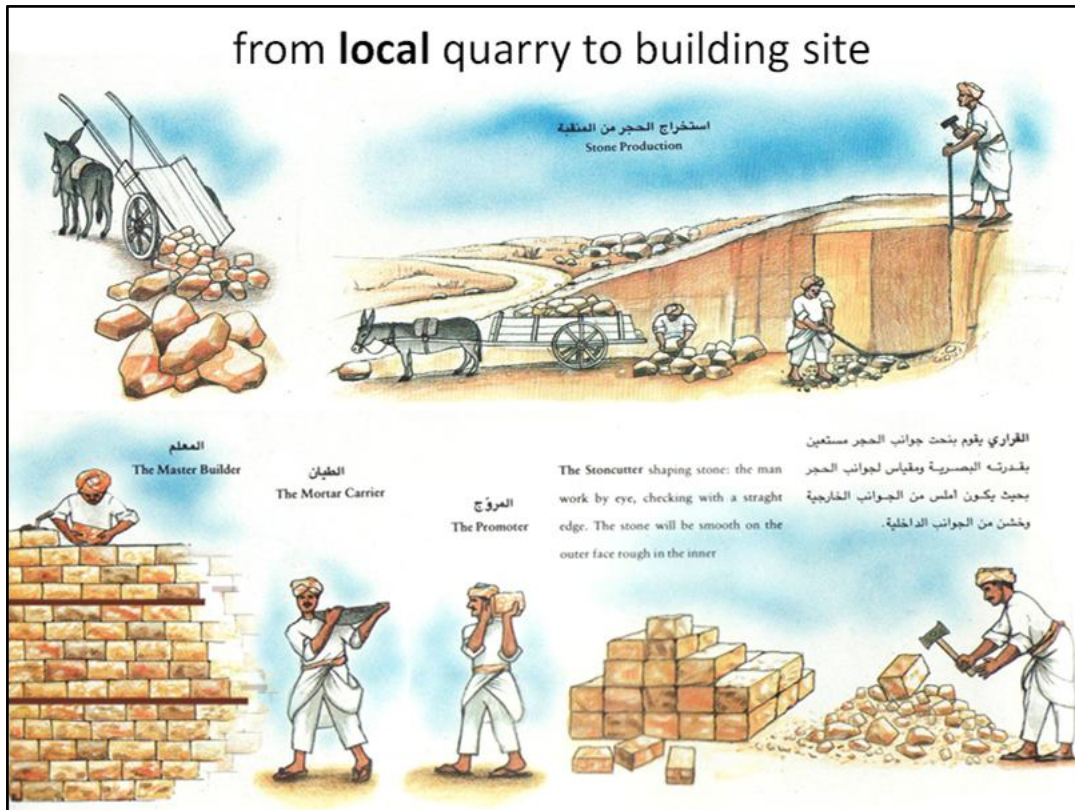


The Rise of the wall happened simply by Collaboration and Utilization of simplest tools available

The rise of the “Mangabi” wall in historic Jeddah happened simply by collaboration

Utilization of simplest tools available

Collaboration was evident from the Stonecutter to the Master builder



**claims that the coral stone used in buildings came from the deep sea** is not right

Fact is, it was brought by a contractor from quarries north of Jeddah and along the sea shore.

Mud was brought from the lagoon right next to us

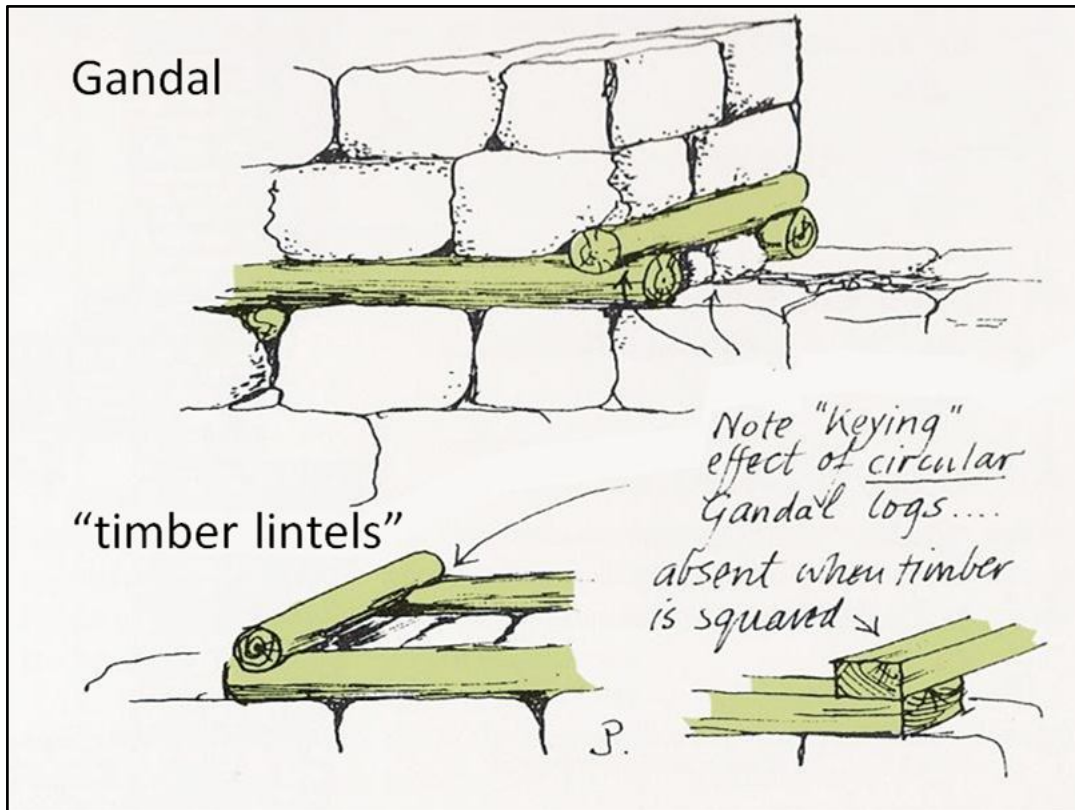
coral stone was delivered to site , where it was finally shaped and squared on site





**“AlGarray”** the stonecutter was **responsible for giving the final stone block the dimension to fit in place**

This was done by a simple hand tool called “Al Shahat”



**The walls of a house was built directly on the ground**

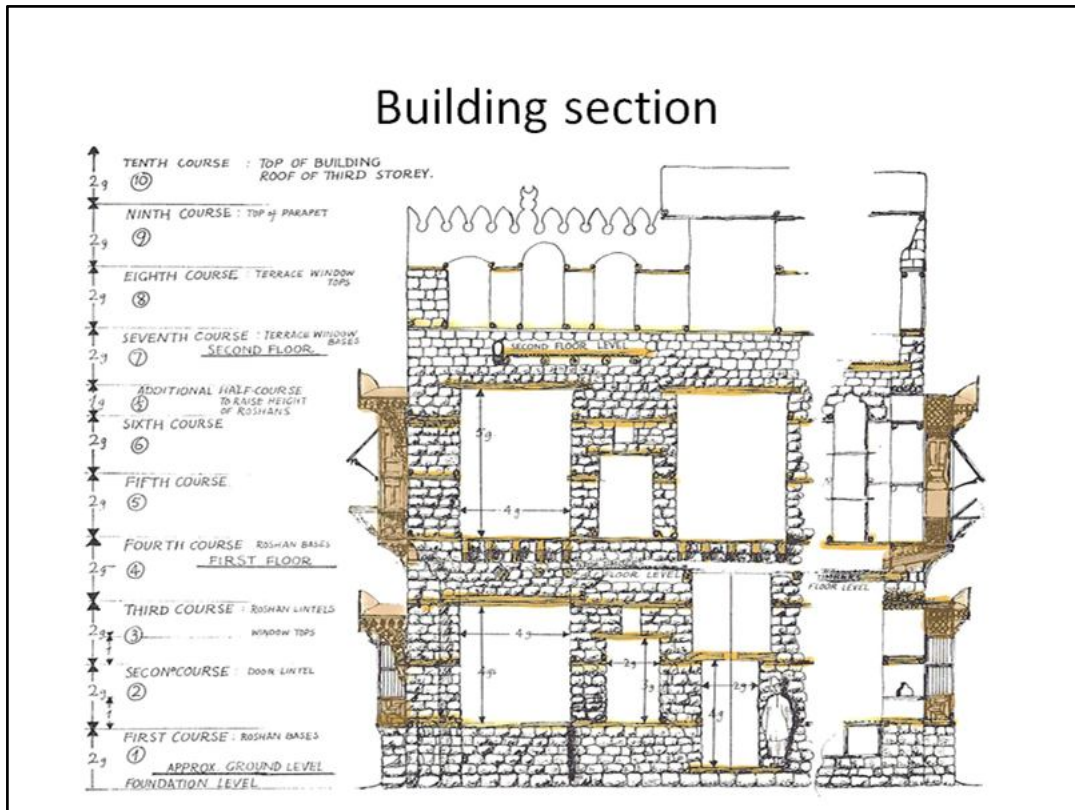
only **20 or 30 cm deep trench** was made to lay the first double stone course, so **no excavation or deep foundations** were needed

The trench was also the plan of the house drawn in 1 to 1 scale

Wall built in **3 sections, interior, exterior and filling in between** in an average of **80 cm total thickness**.

**To distributed the load** on the light coral stone **and tie the interior and exterior sections together**

wood planks "timber lintels" ,(Gandal), or "takail" were laid horizontal, every 6 stone courses or 6 "medmaks" or every 2 (Giddas)



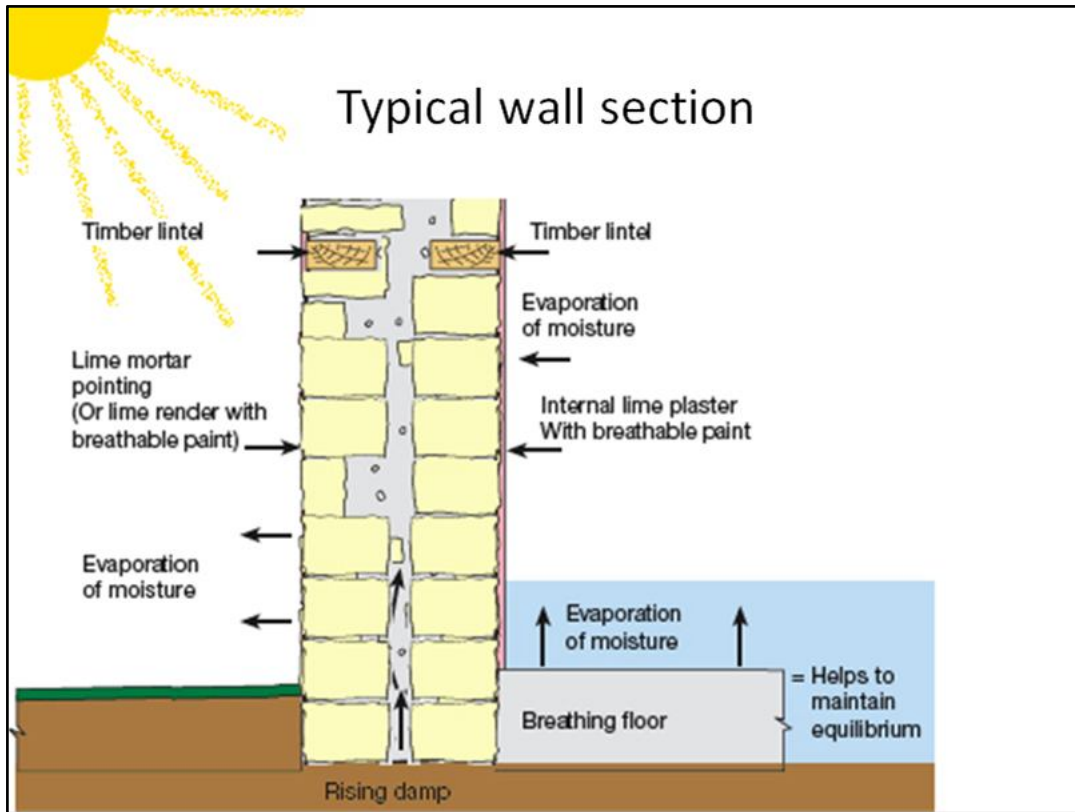
the "Gidda" is 2 feet 60cm

The **module was easy** to implement,

2 Giddas will make 6 Stone Courses 120cm

A **Gandal** will be used **every two Giddas**

**Opening for doors and widows were also measured by Gidda** It was simple fast to erect.



The wall was load bearing structure

**Walls will keep getting lighter** as they climb higher, **each additional floor, cavities were made and subtracted from the wall mass**

Most cavities were used as cupboards in the finished rooms

The roof will end up with a single parapet wall only

We can see how the wall breathes because of the property of Lime stone





The whole house is built and finished using only two elements

**Wood**

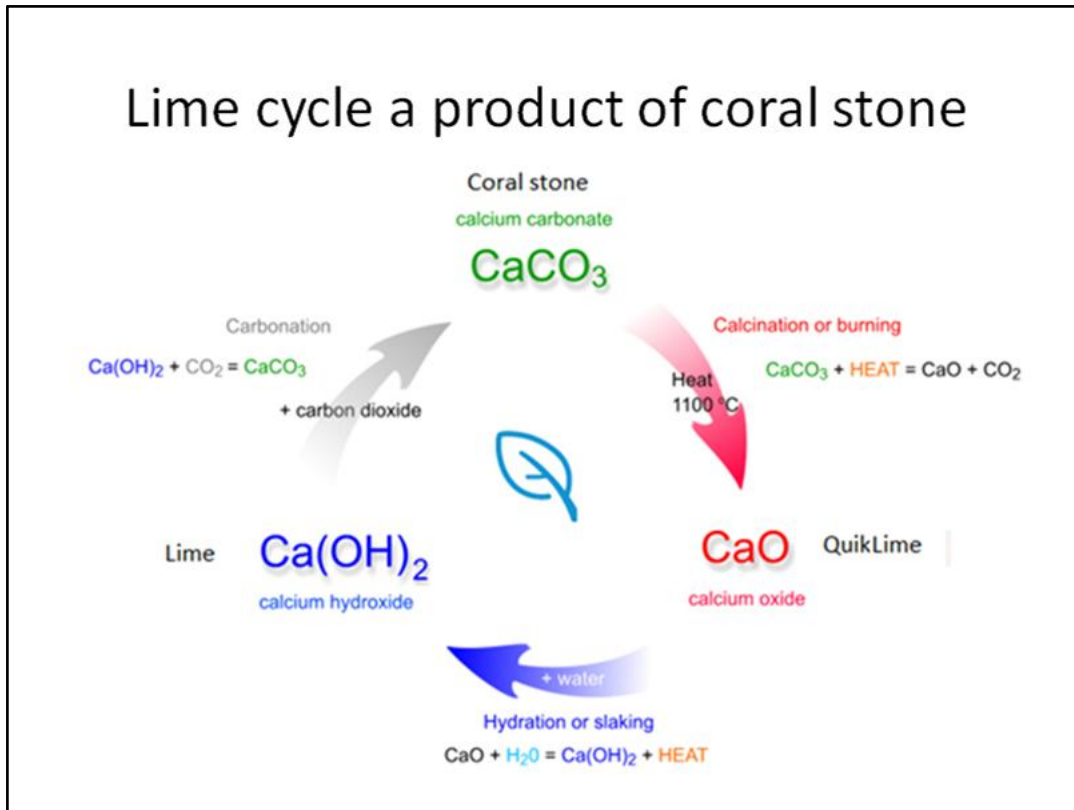
And Calcium Carbonate

**Lime**

in all its forms

Stone, Mortar, Plaster, flooring and wash

Water, Sand, Mud and Gravel made the difference



### Coral stone is one source of Lime

When heated to around 1000 C. It starts giving off carbon dioxide and leaving calcium oxide which is known as **quicklime**.

**Quicklime** is unstable and reacts, often very rapidly, with water to form calcium hydroxide. This process produces heat and is known as hydration.

**When exposed to the atmosphere, calcium hydroxide reacts again by absorbing carbon dioxide from the atmosphere to once again become calcium carbonate.** "carbonation"

**when mixed with sand Calcium hydroxide, makes mortar**. When mixed with water makes **lime wash**

This is known as the lime cycle



Romans  
built with  
**Pozzolan Lime**  
**2000 years ago**

**43m span,**  
**0 steel,**  
and still standing

Lime was used in traditional architecture for centuries

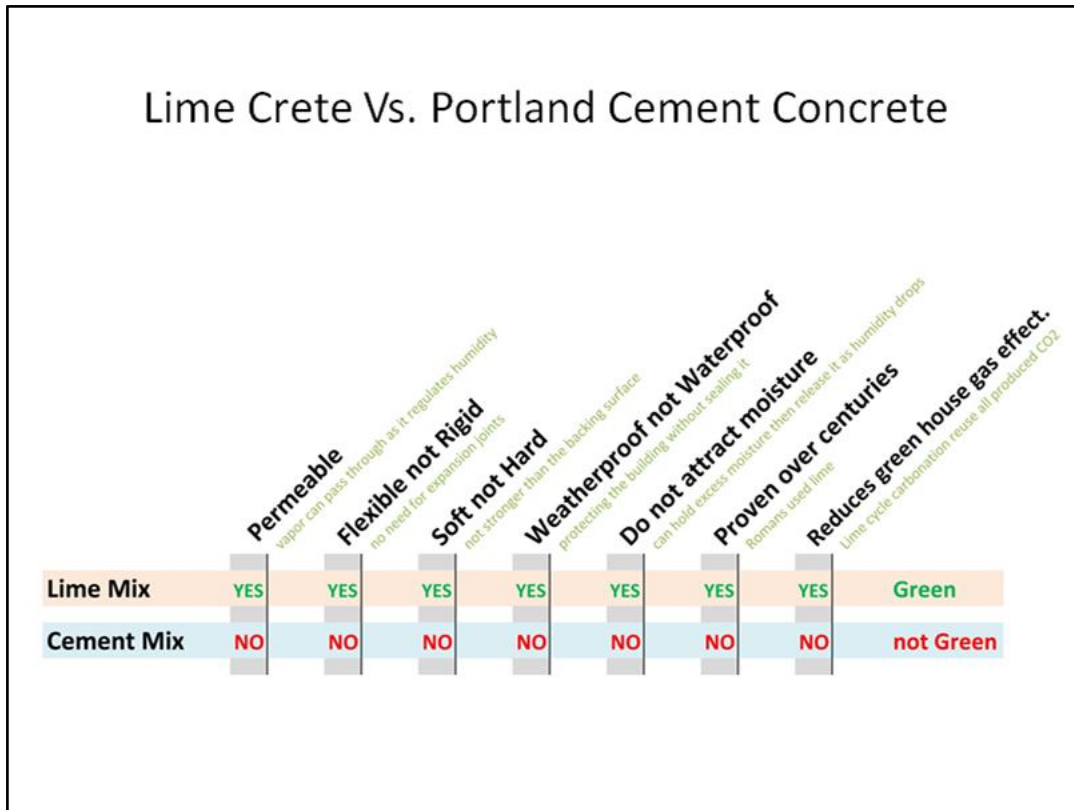
**Romans** discovered that the **Lime would react with volcanic ash**

resulting in a mixes that **set very much harder then lime alone**

**This enabled structures of high strength** to be built.

These reactions are referred to as pozzolanic, from the town of Pozzuoli in Italy where the original volcanic ash came from.

The product was (pozzolanic **lime**, not pozzolanic Portland **cement that we have today** ).



**Cement is lime based** but with added Aluminum, iron, calcium sulfate, and magnesium oxides,  
 it was man made by a British [bricklayer](#) from Leeds early 19<sup>th</sup> century  
 Its mix has an advantage of drying fast, solid and hard

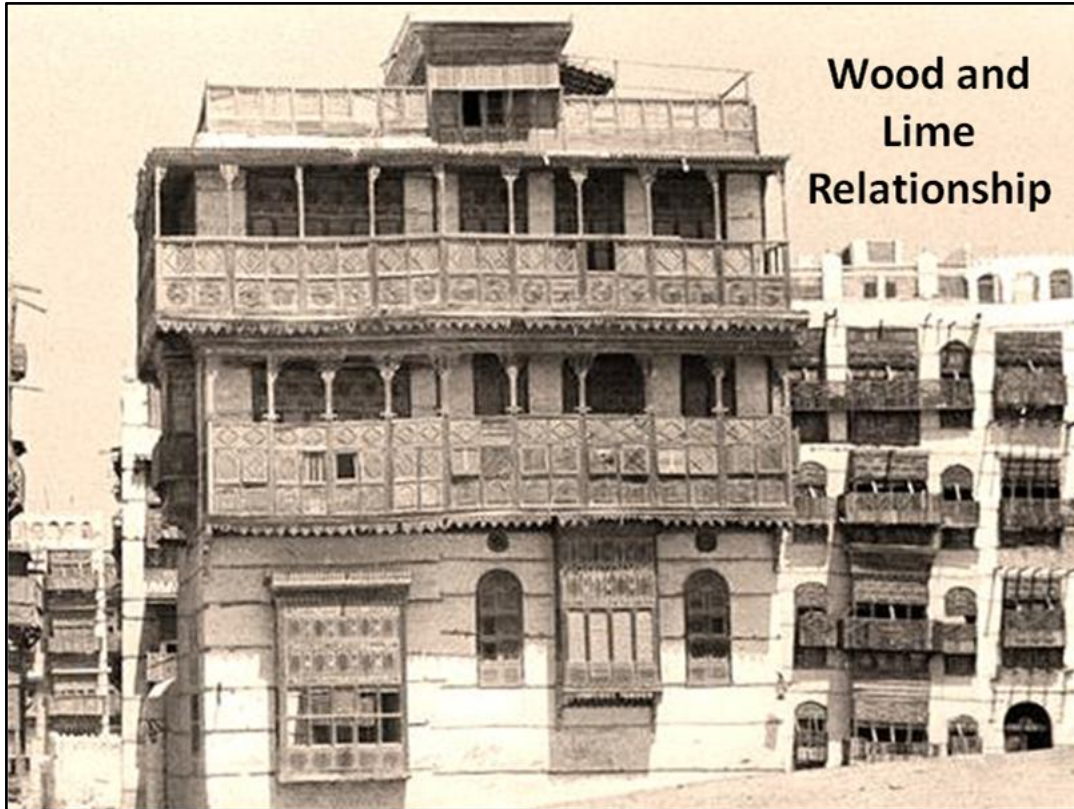
**A quick comparison between lime and cement mix's**

**shows beyond doubt that lime is as green as it gets**

**Lime helped in reducing moisture, adding heat insulation and resulting in cooling the indoor environment,**

**No cement** was used in any of the old structures,

**Cement and lime don't mix well**



## Wood and Lime Relationship

**Lime and steel** do not work with each other

Steel needs total isolation from Air to prevent rust

Lime mix **is permeable** meaning it will allow **air and moisture to pass through** making steel rust

**Wood** and lime are **perfect for each other**





**wood** lintels **distribute the load** lime stone

### **Lime protected and preserved Wood**

lime **repel insects** and termites, and saved wood from mold and decay

That keep all wood element (structural or decorative) intact for centuries

The **big openings in the walls**, helped in weight reduction, wood "**Mashrabias**" covered the openings

The all around **openings provided** maximum **air** movement throughout the house, "**Mashrabias**" **reduced glare** and maintained privacy.

No glass was used.

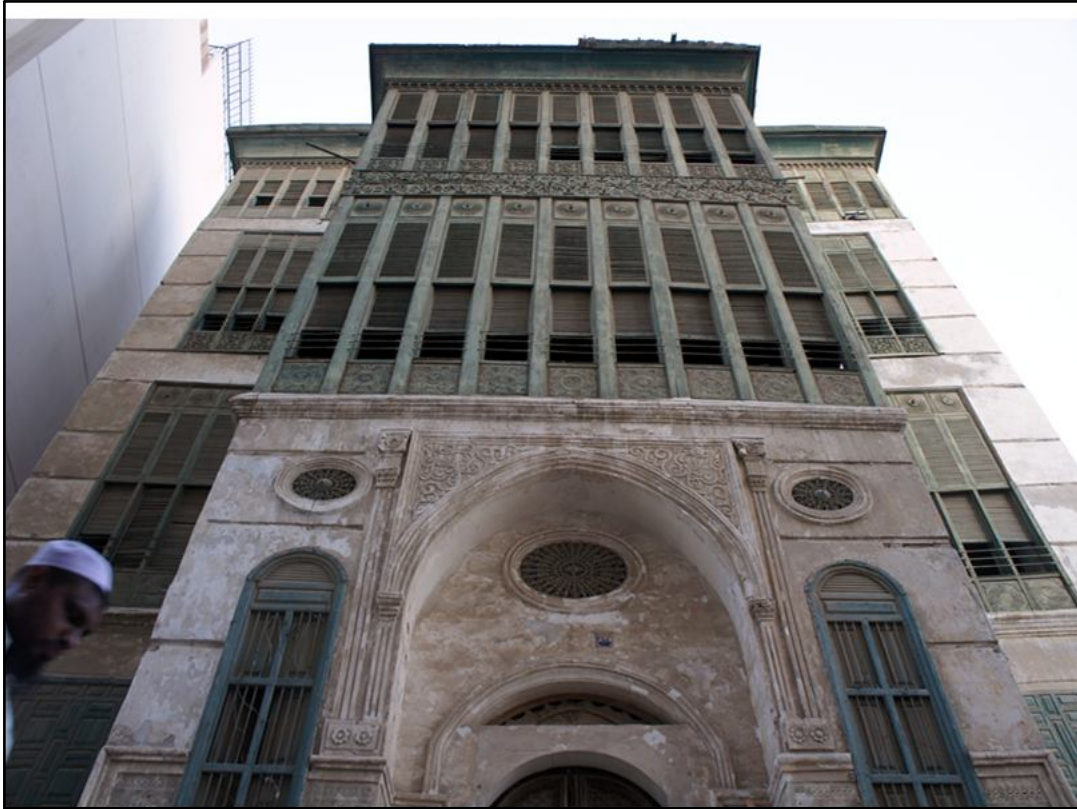


Timber was shaped using simplest tools

according to "Zaker" the oldest carpenter in town, who still lives in his house in the historic district

"We built most of this" referring to historic district "using these simple tools!!"





Hardest wood came with trade ships from bourma India and Jawa,

Some local wood was also brought from wadi Fatma, and Taif, that was used as Gandals

## **Interior space**

High ceilings

Wood finished

Breathing structure



## **Light & Air**

were allowed to  
pass from room to  
the other

Keeping all rooms  
**bright and cool**



Light quality

Air allowed to pass from one room to the other



Wood carving

And lime plaster carvings

decorated the wall and openings



Lime and wood

give the Jeddah the charming physical character that made it the bride of the Red sea



## Traditional House clusters just like coral itself



**Socially the inhabitants** lived in **beneficial relationship** similar to the one between **coral and algae**.

**Like coral bleach , with changes in the local political and economical conditions,**

the last known residents lift these houses for new more comfortable homes,

with AC , glazing, gardens, private space, pumped soft water .. etc.

the reasons are clearly understood

# The Fall

- The Boom
- The modern house
- Abandon property and Neglect
- Socio Economics
- “AlHeker”
- “AlWagf”
- The Rush

Hundreds of reasons and endless stories

I do not want to get to it in this presentation

I can only say that **it was not the stone that failed**

## The **Oil** Boom



Historic Jeddah **reached its peak** at the early 1980s

the **streets were paved and the power and water delivered** to each and every house

Yet, the original **inhabitants abandoned their homes** and built new homes elsewhere

After that it was **neglected and Devalued**

And slowly put to rest



e<sup>-</sup>  
Utility lines  
and ACs

intervention



Fire

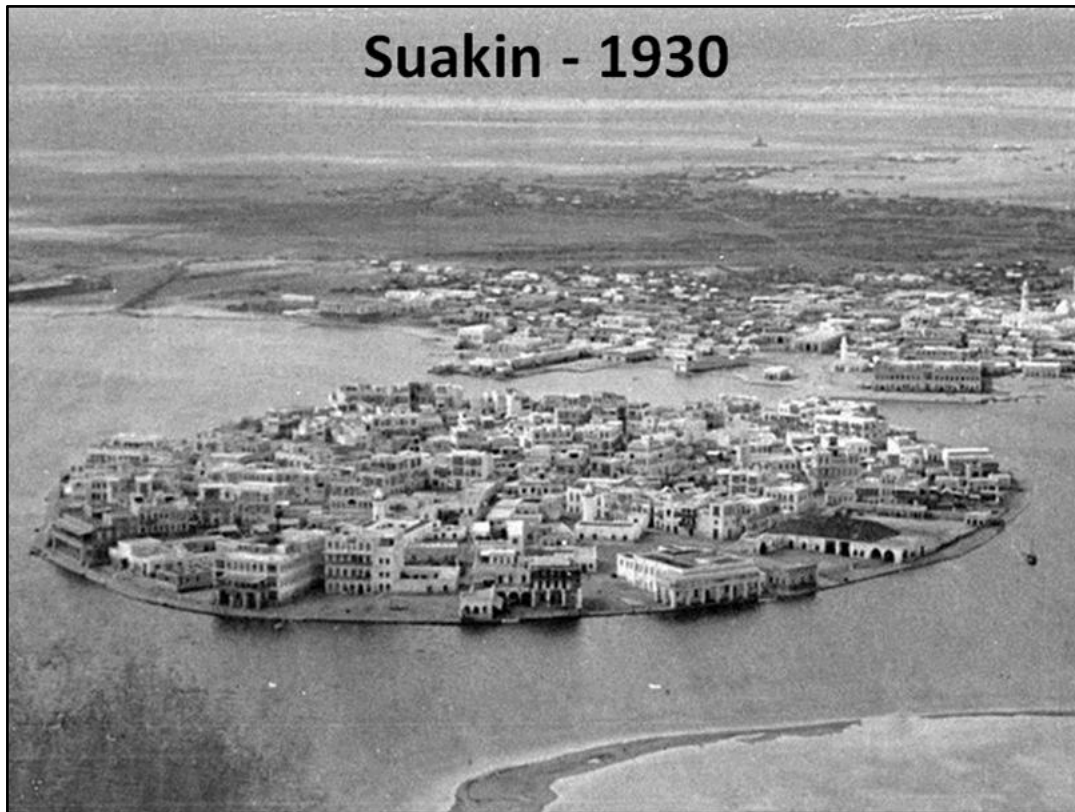
Mostly electrical shortcuts !!





Water

Rain  
storms  
and floods



In fact, **the Red sea coast** on both continents **has similar towns with the exact scenario** of abandon ship.

Yanboo, wajh, Farasan

in Saudi Arabia

### **Suakin**

in Sudan. Built between the 16th and the 20th centuries

**All have vanished** with some or no archeological trace.

## Suakin - 1981



Total decomposition  
From nature and back

I quote

from 1955 the author of the book "coral buildings of Suakin", stated that

**"the structures are nearly all in very sound condition,  
and their collapse is due to lack of normal maintenance"**

# Summary



Do we want the historic District of Jeddah **to end up** like Suakin

**it is still living and giving**

**Should the old be respected and persevered or replaced**

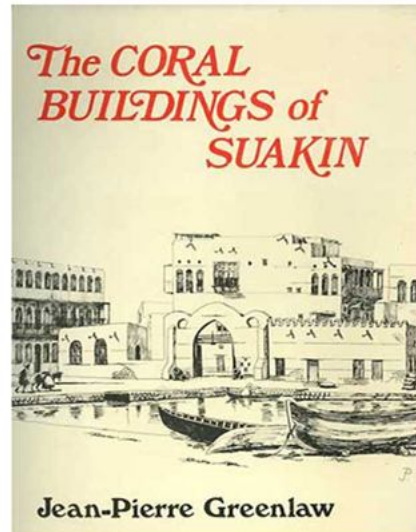
**Should we learn from the past or never look back**

**Can we be more innovative and local in or approach**

**Should we take the traditional image or its essence**

**The modern building are super luxurious , but are they efficient, can we adapt some thoughts from the past to improve them**

## Preservation efforts are needed



**The way forward** requires **more than** preservation

**It is good to record** and protect **accumulated knowledge** or it **will be forever lost**.

"The coral Buildings of Suakin 1976";

**This is a great example of documenting** and preserving such marvelous structures. **20 years to make it**

**I wish Jeddah had published a similar book at least.**

Should Architectural Schools of Jeddah **teach this book**

**Or publish one about Jeddah!**

**Protect** means **we do not use cement in restoration** it will **only aid in bringing it down**



## Restoration efforts are needed



**Restoration is important for the next generation pride in history**

But innovation and learning from the old and tested is more important for the future

Nasif house was restored

300 to go

A historic district is the cultural introduction to the present, **"What's past is prologue."**

— [William Shakespeare](#)



Research centers could aid in finding a good use of all this waist

Is it **economically viable**,

It **saves in material cost**, It **saves in energy**, Saves in **transportation**

the material used is as **local** as it gets, it provides healthy indoor environment .. It is Green

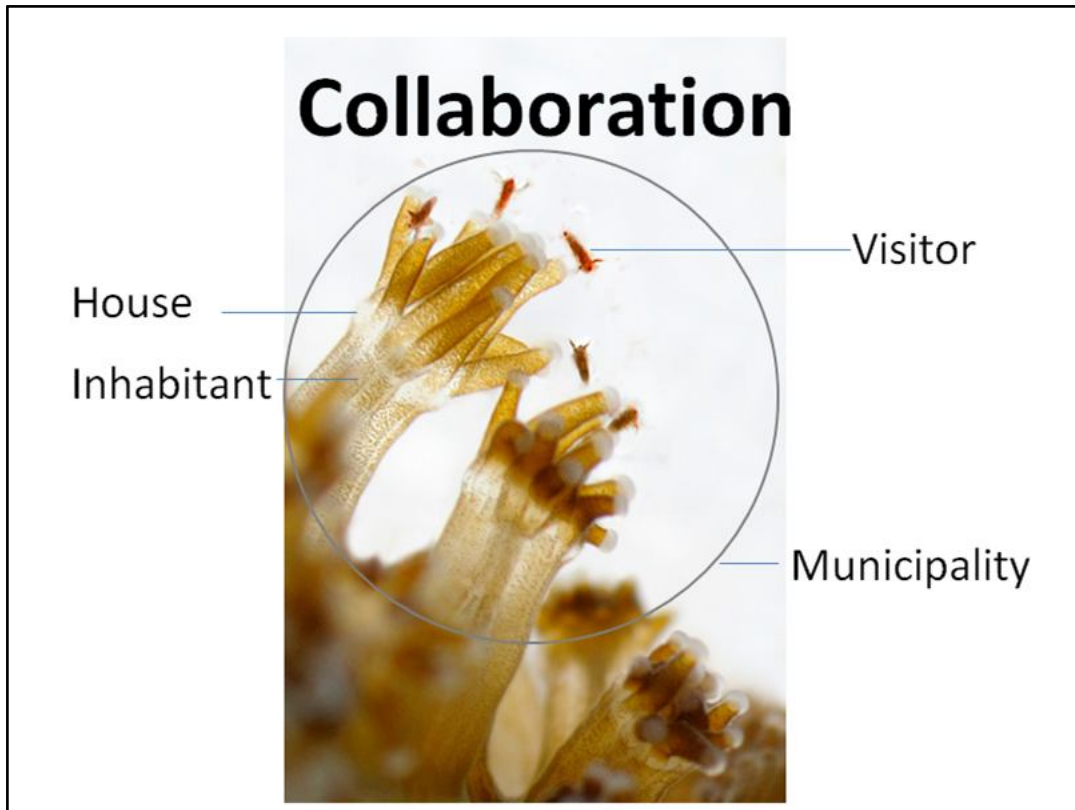
**The rush** made cement preferred because **time is money (time of building or the life of building)**

Like lime and volcanic ash, **Lime and a new additive** might be the new building revolution maybe (silk)

Laminated wood beams can span 90 (**Richmond Olympic oval**)

**Lets have a competition to design the most sustainable contemporary house using local ideas**

**Utilize Nature** everything comes from it any way



This is the most important need – the problem today is in lack of collaboration

Remember nature in the **importance of collaboration**

We have to apply this in Jeddah's heart

**Owners need help** in preserving the **irreplaceable structures** they have.

**The Municipality system** and **the work process** should be **inviting and aiding** the owners to restore.

**possible is nothing** should be replaced by **impossible is nothing**

**Schools and research centers can positively contribute**

We have seen how animals of 1 mm in size were able to build the largest structures of the world "the coral reefs".

Now these tiny creatures play a major role in the balance of our nature and in continuing the cycle of life.

We are no deferent.



The **wall is embedded with knowledge** that dates back to the past millennium

the **wall stands as a book with infinite opportunities to research, and to learn from**

to **simply ignore** this treasure and try **to reinvent the wheel**, might not be the smartest approach

We have to ask our selves What are we replacing it with

Thank you for your time