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# The Eastern African Marine Ecoregion

## Lime Production from Land-Based Fossil Corals

### Traditional Lime Production Process

Live coral mining has a long history in the western Indian Ocean. Mined coral is used as building blocks and aggregates or burnt on open kilns to produce white lime; a cheap substitute for cement and a whitewash for painting buildings. In many areas this practice has now reached unsustainable levels and is considered to be one of the main contributors to reef and forest degradation along the coast.

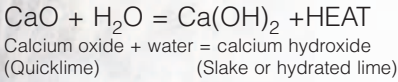
Live coral boulders, mainly of the genus *Porites* are collected in the upper reaches of the reef or extracted as broken pieces from larger coral heads using iron bars. The reason why this coral is preferred is due to its widespread occurrence and higher quantities of lime being produced.

The construction of a typical kiln consists of a circular base of fuel wood in ordered size layers with broken pieces of coral laid on the top. The size and amount of fuel wood and coral used varies in relation to kiln size which range

from small kilns a few meters in diameter to large two storey kilns five meters across. It is estimated that 2 tones of fuel wood and 4 tones of corals are used for a small kiln and 5-6 tones of fuel wood and 8-10 tones of corals are used on a large double storey kilns.

After the coral kiln is prepared it is burnt. The length of time for a kiln to burn and cool down varies from 48hrs for a small kiln to up to 7 days for a large two-storey kiln. Once the kiln has cooled to workable temperatures hydration of the burnt coral is conducted using either saline or freshwater. For inland kiln sites water is taken from local wells. The pouring of water over the burnt coral causes the following chemical reaction:





For a large size kiln approximately 1000 liters of water are required

After hydration, the coral lime powder is placed into second-hand cement bags. Approximately 200 bags are obtained from a small kiln, between 300 and 400 for a medium kiln and up to 700 bags for a large two storey kiln. In Tanzania a 15kg bag of lime is sold for between \$ 0.70 and \$ 1.20. This is compared to a bag of cement which costs approximately \$ 10

Despite a National government ban on live coral mining in Tanzania a combination of poor

enforcement, a lack of alternative similarly priced building materials, and the fact that the sale of lime provides much needed income to local communities has meant the practice continue and in some areas has intensified. This is highlighted by two studies conducted in southern Tanzania which found fuel wood use and live coral mining to be far beyond sustainable levels

Despite the damages caused by coral mining, the income potential this industry provides to local communities cannot be ignored in terms of needs and profit return. The lime industry may supersede most if not all other artisanal coastal resource activities. There is therefore a need to promote the application of sustainable methods for lime production using land-based sources of fossil corals.

A Case Study: TANZANIA			
Location	Number of kilns per year	Total tones of coral per year*	Total tones of wood per year**
Kilwa	264	840	1368
Lindi	756	2808	4344
Mtwara	960	3000	4800

\* Equivalent to 1,400 trees and 1,448 lorry loads of live corals per year

\*\* Equivalent to 1,500 trees and 1,600 lorry loads of live corals per year

### Unsustainable impacts:

The negative natural & socio economic impacts of unsustainable live coral mining are well known and include:

- Reduction of shelter and refuge for reef fish and marine life
- Decline in diversity of corals and reef fish
- Decline in abundance of local fish populations and consequent impacts on local livelihoods
- Reduced integrity of coral reefs and loss of aesthetic value for tourism
- Local deforestation to provide fuel wood
- Removal of natural breakwater to reduce wave impact along the coast
- Increased erosion of shoreline.

#### Mtwara District

Total Gross profit= US \$ 72,000 Per annum

#### Kilwa & Lindi Districts

Total Gross Profit = US \$85,000-110,000 per annum

## Alternative Lime Production: Is it possible?

One potential alternative of the use of live coral for lime production is the use of land based limestones. Mainly consisting of fossilized corals these limestone are found in abundance along the East African coast. The alternative land-based limestones produce high quality lime and are advantageous because they contain no sea salt which often causes problems of paint and plaster deterioration and the mining does not damage marine habitats.

For the burning of land based limestone an improved artisanal kiln has been developed. The kiln differs from the traditional design by being nearly three times larger, uses coconut logs and coconut husks as the main fuel source and with the aid of a traditional wall of coconut trunks the kiln is completely encased in a

dome of pieces of broken lime stones. This enables the limestones to burn at a higher heat and after firing the kiln collapses inside the retaining wall.

Approximately 30 tones of limestones are used in this kiln and about 30 coconut logs which are cut into two meter length both for burning and to act as the retaining wall. One kiln takes 10 people two weeks to collect the limestones and build the kiln. Each kiln can produce approximately 2,450 bags of lime weighing 25kgs each.

Small-scale commercial flare or pot kilns built from burnt bricks are also suitable for alternative lime production and have the advantage of greater fuel efficiency although are more technical demanding to operate.

### Fact 1:

Despite large deposits of land based limestones being present along the coast, local communities do not recognize the potential or are unaware of the methods involved.

### Fact 2:

With lime increasingly used as cheap substitute for cement demand is increasing. With the right development of alternative limestone industries real and tangible benefits can be provided to local communities without associated negative impacts to the surrounding environment.

## Action Plan for Lime production Using land Based Limestone

### Prospecting

The prospector will require a basic knowledge of lime production to be able to identify suitable limestone materials and to understand the extent and thickness of limestone needed for the lime production operation

Geological maps or reports of the area, if produced, may help to identify potential areas of limestone and its suitability for lime production

## The Technical Survey and Progress Report

A more detailed survey of the selected areas will be required. This will include sampling of the visible reserves, laboratory analysis of the limestone and kiln firing trails. A report should be prepared from the above surveys and include the following findings (Wingate 1985):

- The quality of the produced lime
- A reliable estimate of the economically exploitable resources in metric tones
- The cost of preparing each metric tone of limestones for firing
- The location of the deposit in relation to available or potential markets and any special problems such as site access, which may need to be addressed
- The type, availability and cost of fuel in the areas
- Whether initiatives such as timber plantations or making briquettes of biomass fuels need to be developed or implemented to meet future fuel demand
- An assessment of availability and potential markets together with the local price of lime

### Fact 3:

Gross profit return of a single improved artisanal kiln is approx US\$ 500. Two kilns can be prepared each month providing a minimum of \$65 per month per person for a co-operative group of 15 people. This amount could be increased further if the group provided all the labor input.

### Research on the potential of Biomass Briquette making as an alternative fuel source

Due to the pressures of fuel supply in the lime production industry a specific project should be organized to develop and evaluate techniques for making briquettes of biomass materials. Research should be focused on simple or low technology methods affordable by artisanal lime production.

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### Demonstration projects

If a proposed lime project is proven to be viable a demonstration project should be considered. An effective demonstration project should provide information on:

- Methods of limestone identification
- Quarrying methods
- Improved kiln construction. This should include the improved artisan dome kiln but if appropriate the more sophisticated flare/pot, climbing or continuous production kilns can be demonstrated.
- Slaking of the lime
- Grading of the lime to produce a better product
- Available and potential markets for lime products

