MEXICO CITY, SEPT. 2018.
Next Generation Awards Lab.

TRISTAN DA CUNHA ISLAND:
FROM VOLCANIC ASHES TO
CONCRETE POZZOLANA.

ANTOINE AMPHOUX & TITOUAN CHAPOULY
RPG - Research in Practice Grants, LafargeHolcim Foundation
200% increase in shipping costs for raw materials over the last 5 years.

THE MOST REMOTE INHABITED ISLAND AS A CASE-STUDY PROJECT

ST HELENA ISL. 2,000km (1,242mi)
CAPE TOWN 2,400km (1,500mi)
RIO DE JANEIRO 3,360km (2,090mi)

Approximate distances and data extracted from Agulhas Research Vessel 2012 Report.

UK aids to Saint-Helena, Ascension and Tristan da Cunha

Budgetary Aid  Shipping Subsidy  Development Aid  Technical Cooperation

£ million

2,062m (6,765ft)

THE SETTLEMENT

10km (6.2mi)

UK Overseas Territory
volcanic island inhabited for 200 years (1816)
No airport / harbour facility

A. Amphoux & T. Chapiouly - RPC - UH Mexico City Lab, Sept 2018
A RESILIENT COMMUNITY OF 268 INHABITANTS

THE SETTLEMENT

UK ADMINISTRATION

THE FACTORY

COMMUNITY CENTER

THE SCHOOL

THE HARBOUR

DOLOMIES SHIPPED BY THE ROYAL NAVY IN 2008. COST: £7 MILLION

ISLAND'S GOODS

1 M³ OF CONCRETE ON THE ISLAND = 1,400€

WATER SUPPLY

FARMING

CONSTRUCTION

CORRUGATED METAL SHEET - ASBESTOS CEMENT - BLOCKS...
## Genius Loci: Shells and Ashes

### Lobster Catch - t

<table>
<thead>
<tr>
<th>Island</th>
<th>1979</th>
<th>1999</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gough Island</td>
<td>16.4</td>
<td>95.65</td>
<td>67.33</td>
</tr>
<tr>
<td>Nightingale Island</td>
<td>44</td>
<td>5242</td>
<td>7226</td>
</tr>
<tr>
<td>Inaccessible Island</td>
<td>67</td>
<td>64.18</td>
<td>114.47</td>
</tr>
<tr>
<td>Tristan da Cunha Island</td>
<td>24.7</td>
<td>122</td>
<td>180</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>449.7</td>
<td>332.79</td>
<td>434.85</td>
</tr>
</tbody>
</table>

- **75% of the Island's economy**

### Red Sand Area

A. Amphoux & T. Chalopoul - RGS - Lil Mexico City Lab, Sept. 2018
A VERY LOCAL CONCRETE RECIPE

Lime process

Crawfish shell composition:
65% CaCO₃ (calcium carbonate) + 35% C₈H₁₃O₅N (Chitin)

1. Crawfish shell Calcination:
CaCO₃ → CaO + CO₂

2. Lime Hydration:
CaO + H₂O → Ca(OH)₂

Pozzolana cement composition:
SiO₂ + Al₂O₃ + Ca(OH)₂

1. Extraction
2. Crushing

Extraction

1. Extraction
2. Crushing

Collecting

Drain

Pozzolana
Lime
Sand
Gravels
Eroded Stones
 Crushed Basalt

Lignocellulosic
Organic materials

Water Sources

Concrete blocks
190x190x400mm

Cement 19%
Aggregates 67%
Fibers (reinforced concrete) +%
Water 14%

80% 20%

A.Amphoux & T.Chipoully - RPG - Lh Mexico City Lab, Sept. 2018
POTENTIAL PRODUCTION: 2 HOUSES PER MONTH

Sample developed with the advice of:
- Pozzolane des Domes (carry, Auvergne, FR)
- Prof. Gargiani (historian of construction, EPFL)
- Prof. Amziane (civil engineer, Blaise Pascal Univ., Fr.)

Potential Lime production
Lobster catch
400 t/year

After transformation:
152.3 t/year

Potential concrete production
each day:

0.20 m
3 m
10.5 m
linear: 315m a month

Typical buildings surfaces

Common house
145 sqm

Community building
500 sqm

Crawfishing Factory
1590 sqm

A. Amphoux & T. Chiapouly - RPG - LH Mexico City Lab, Sept. 2018
**BESPOKE BUILDING TECHNOLOGIES**

**PROTOTYPE: A TOOLS HUT**

**ROOF: SELF-SUPPORTING STRUCTURE.**
Rwanda Droneport sheel. Norman Foster + partners.

**WALLS: SMART BLOCK SYSTEM.**
A self-built constructive method, assembled by non-specialized workers.

**TOOLS AND FORMWORK: REUSE OF LOCAL DISPARATE ELEMENTS / MACHINES.**

- Dolesses moulds
- Casting Wood system
- Front Excavator / lifter
- Carbon fibers boats

A.Ampfloux & T.Chapouly - RPG - LH Mexico City Lab, Sept. 2018
A 2 YEAR LONG AGENDA

2018
- Present project to the Administrator of Tristan da Cunha, Alex Mitham, and Island Council.

2019
- NEXT GENERATIONS AWARDS LAB Mexico City.
- Site investigation or extraction of samples for research purpose.

2020
- 1st PHASE_Framework.
  _ Research in Practice Grant plan development in collaboration with Academic Committee of the LafargeHolcim Foundation and business specialists.
- 2nd PHASE_R&D.
  _ Chemical properties Test within LH Research Center in Lyon (LCR) based on TDC Geological Survey.
- 3rd PHASE_R&D.
  _ Prototyping 1:1 Structure to test smart block construction within LH Research Center in Lyon (LCR).
- "2020 Venice Biennale".
  Presentation for potential investors and financial collaborations.

2021
- 4th PHASE_Logistic.
  _ Logistic with Lafarge Holcim network and development of site production method. Transfer on site in collaboration with British Overseas Territories Department.

2022
- 5th PHASE_Durability.
  _ Implementation of further practical solutions and potential applications of Micro-scale tools for sustainable construction within LH Start ups Accelerator.
- Infrastructure, offshore and related buildings.
- Buildings _ Community workshop _ Material fabrication factory and storage.