

# Celtic Sea Minerals

Natural, bio-available minerals from the seabed



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Celtic Sea Minerals specialises in the development, manufacture and marketing of natural animal feed, hygiene and environmental products based on

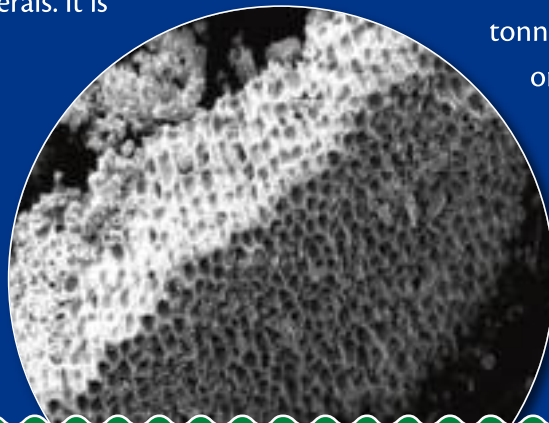
calcareous marine algae. The marine algae are harvested under government licences from reserves off the coasts of Ireland and Iceland.



## Calcareous Marine Algae

Calcareous marine algae is the collective term for several species of calcified red seaweed. Calcareous marine algae are slow growing and can form extensive beds in favourable conditions, typically in relatively shallow and clear, unpolluted coastal waters where there is some tidal flow.

The live plant contains a pink pigment on its surface, which traps sunlight to provide energy for its growth. In time a white calcareous skeleton develops, which is rich in calcium and other minerals. It is only this skeletal material that is harvested from the seabed primarily for its significant value as an animal feed raw material and acidic soil conditioner.



The calcareous marine algae (*Lithothamnion*) forms the basis of the range of products from Celtic Sea Minerals..

## Harvest Sites

Celtic Sea Minerals harvests in two key locations: the original *Lithothamnion* site off the south west coast of Ireland – which has been worked since 1991 – and a significant and plentiful new reserve in Arnarfjordur, a fiord in the north west of Iceland.



The south west coast of Ireland



The Arnarfjordur fiord, north west Iceland

The Icelandic source contains up to 35 million tonnes of *Lithothamnion*, compared with only one million tonnes off the coast of Ireland. Celtic Sea Minerals harvests the *Lithothamnion* through a joint venture agreement with a local company.



## Lithothamnion – a superb natural physique!



### Manufacturing Process

#### Harvesting:

*Lithothamnion* is harvested via a suction pipe descending from a vessel. The wet raw material is deposited in the ship's storage tanks as the vessel moves slowly forward, with the harvested water returning to the sea. Being a natural harvest, Celtic Sea Minerals is governed by strict regulations to ensure no damage to the environment or surrounding sea-life.

#### Washing and Drying:

The *Lithothamnion* harvested from the seabed is first washed to remove sand and silica. It is then dried at 125°C for 16 minutes, ground to a fine particle size and then packed or blended to customer specification.



Washing



The clean raw material



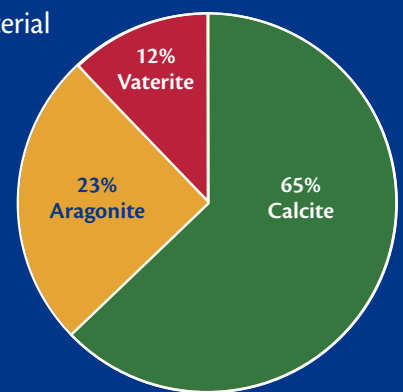
Drying



Bagging

*Lithothamnion* is a highly effective source of minerals, particularly calcium and magnesium – plus 72 other minerals – and the secret to its nutritional value lies in its honeycombed physical structure.

Detailed analysis of the material has revealed that it actually contains three different calcium structures – calcite, aragonite and vaterite. Whereas calcium carbonate is 100% calcite, *Lithothamnion* is actually 65% calcite, 23% aragonite and 12% vaterite.



**Lithothamnion analysis**

Aragonite and vaterite are polymorphs of calcite, which means they have the same chemical make-up, yet differ structurally (ie. different symmetry and crystal shapes).

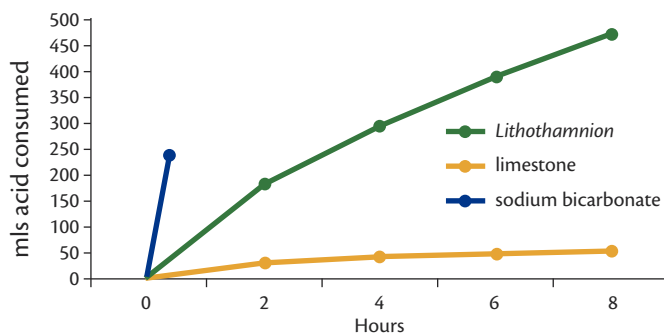
Mineral	Lattice Structure
Aragonite	Orthrhombic
Calcite	Rhombohedral
Vaterite	Hexagonal

Significantly from a mineral nutrition standpoint, polymorphs also differ in terms of their other physical properties such as melting points and solubility.

## Great physique = slow release minerals:

Thanks to its physical structure, *Lithothamnion* is a highly effective rumen conditioner – far better than other available animal feed buffers. In an acid environment, the material breaks down slowly – neutralising significant amounts of acid over a longer period.

### Acid neutralised by limestone, *Lithothamnion* and sodium bicarbonate at pH 5.5



## Great physique = soluble and bio-available minerals:

As *Lithothamnion* solubilises it releases its minerals – and soluble minerals are bio-available minerals to the animal. After 6-8 hours at pH 5.5, 100% of its calcium has been released and 98.66% of its magnesium. This compares very favourably with other common feed mineral sources which can be of variable quality and solubility (tables 1 and 2).

Table 1: Calcium release (%) over time at pH 5.5

	0-2 hours	2-4 hours	4-6 hours	6-8 hours
<i>Lithothamnion</i>	56.71	74.57	87.55	100.00

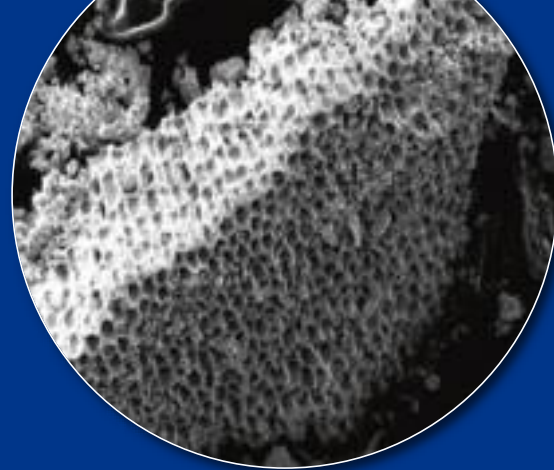
Table 2: Magnesium release (%) over time at pH 5.5

	0-2 hours	2-4 hours	4-6 hours	6-8 hours
<i>Lithothamnion</i>	86.17	87.16	95.96	98.66



# Lithothamnion

## from Celtic Sea Minerals



### Physical specification:

Grey powder  
Particle size: 100% < 250 microns

### Analysis:

Ash 95%  
Moisture <5%  
Calcium 30%  
Magnesium 5.5%  
Potassium 0.7%

### Other minerals (approx):

Phosphorus 500ppm  
Boron 10ppm  
Iron 800ppm  
Cobalt 0.1ppm  
Copper 10ppm  
Zinc 10ppm  
Manganese 50ppm  
Molybdenum 0.2ppm  
Selenium 1.8ppm  
Iodine 30ppm

### Heavy metals:

Lead < 5ppm  
Arsenic < 5ppm  
Mercury < 0.1ppm  
Cadmium < 2ppm  
Fluoride < 500ppm

### Bacteriology:

Salmonella Absent in 25g  
*E.coli* Absent in 1g  
Yeast and moulds Less than 10/g

### Product Applications

*Lithothamnion* is the basis for a range of products from Celtic Sea Minerals:

#### Animal Feed Applications:

Acid Buf (dairy): rumen conditioner  
Acid Buf (pigs): mineral supplement  
Aquacid and AquBalance (horses): mineral supplements

#### Hygiene Applications:

Dri-Li (all animals): ultra-absorbent bedding conditioner

#### Environmental Applications:

SeaCal: fertiliser grade  
Bio Buf & Bio Filter Media: water treatment products

#### Marigot Ltd (sister company of Celtic Sea Minerals)

#### Human Food Applications:

Aquamin F, Aquamin TG and Aquamin S:  
Natural calcium & essential minerals for the human food industry.





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