

# Uranium-series Dating and Growth Rates of the Cool-Water Coral *Desmophyllum dianthus* from the Chilean Fjords

Malcolm McCulloch<sup>1</sup>, Paolo Montagna<sup>2</sup>, Gunter Försterra<sup>3</sup>, Graham Mortimer<sup>1</sup>,  
Verena Häussermann<sup>3</sup> and Claudio Mazzoli<sup>4</sup>

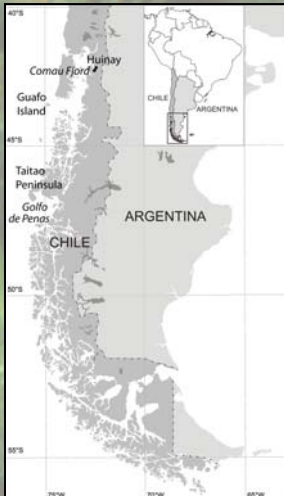
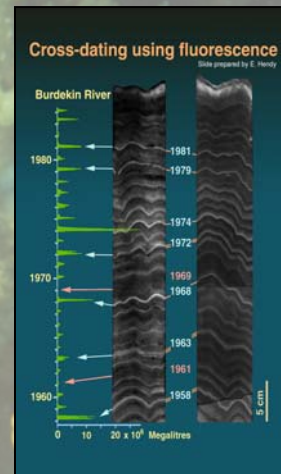
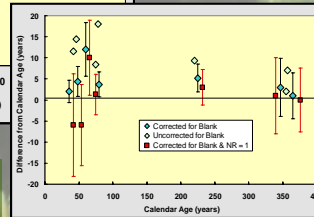
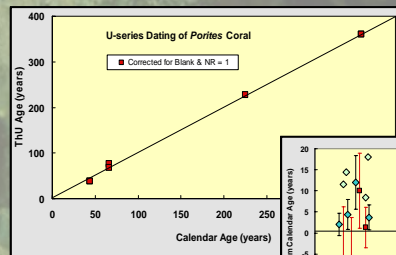
<sup>1</sup>Research School of Earth Sciences, Australian National University, Canberra, Australia, <sup>2</sup>Central Institute for Marine Research, Italy  
<sup>3</sup>Huinay Scientific Field Station, Chile, <sup>4</sup>Department of Mineralogy and Petrology, University of Padova, Italy.

## Introduction

Cold water corals represent an important and still little understood coral reef ecosystem which is highly vulnerable to human activities. In the Chilean fjords, *D. dianthus* occurs in water depths up to ~20m (Försterra and Häussermann, 2003) providing a unique opportunity to study a cosmopolitan community normally found at bathyal depths. Understanding the age distribution and growth rate of these newly discovered ecosystems is of particular importance, especially due to the threat from increased nutrients associated with the rapid expansion of salmon farming in the Chilean fjords.

## U-Series Dating of 'Modern' Corals

Uranium series dating is based on the decay of <sup>238</sup>U to its daughters <sup>234</sup>U and <sup>230</sup>Th. High sensitivity MC-ICPMS methods developed at RSES now enable determinations of <sup>230</sup>Th generated within the carbonate skeleton of young corals of several years in age. A major uncertainty is the composition of the non-radiogenic <sup>230</sup>Th/<sup>232</sup>Th that is incorporated into the coral. To check the accuracy of the method, a *Porites* coral of known age from the Great Barrier Reef was also dated. Results shown below illustrate the excellent agreement between the measured and known ages.



## Site Description

In the Chilean fjords *D. dianthus* occurs within the photic zone, which can be readily collected by SCUBA (Försterra & Häussermann, 2003). Sampling was undertaken from the region south of the Comau Fjord (Huinay Field Station) to the Taitao Peninsula. The fjords are subject to large freshwater inputs from glacier and river runoff with the corals living below the thermocline at temperatures of 8 to 13°C and salinities from 28.5 to 34‰.

## Age & Growth rates of Chilean *D. dianthus*

Dating of the uppermost (living), mid-portion, and oldest basal sections from an ~23 cm long skeleton gave ages of 7 (±5), 17 (±4), and 44 (±4) years respectively. All of these samples have relatively high [<sup>230</sup>Th/<sup>232</sup>Th] of 10 to 30, hence corrections for non-radiogenic <sup>230</sup>Th are less important. The basal age of ~44 years is consistent with the number of tabulae (~37 ±2) implying that they are secreted annually. Thus, within the first 1/3 of its life, this specimen grew at ~1 to 3 mm per year, accelerating to ~10 mm per year in its latter growth stages. Similar growth rates have been determined in other specimens.



| Sample         | Dist from base (cm) | U ppm | % <sup>230</sup> Th Blank | [ <sup>230</sup> Th/ <sup>232</sup> Th] | [ <sup>230</sup> Th/ <sup>238</sup> U] | δ <sup>234</sup> U | Age years | Corrected Age years NR 2 ±2 |
|----------------|---------------------|-------|---------------------------|---|--|--------------------|-----------|-----------------------------|
| DD7 top        | 23                  | 2.72  | 42.3                      | 13.55                                   | 0.000119 ± 34                          | 145.4 ± 2.4        | 11.3 ± 3  | 9.6 ± 5                     |
| DD7 top dup    | 23                  | 3.08  | 45.9                      | 12                                      | 0.000080 ± 30                          | 145.9 ± 1.6        | 8.0 ± 3   | 6.7 ± 5                     |
| DD7mid         | 12                  | 3.25  | 31.5                      | 9.54                                    | 0.000280 ± 44                          | 147.1 ± 1.7        | 26.5 ± 4  | 20.9 ± 7                    |
| DD7 mid dup    | 12                  | 2.84  | 17.4                      | 15.55                                   | 0.000181 ± 18                          | 146.9 ± 1.3        | 17.2 ± 2  | 15.0 ± 4                    |
| DD7 bottom     | 3                   | 3.58  | 24.4                      | 20.28                                   | 0.000561 ± 30                          | 146.7 ± 1.7        | 53.3 ± 3  | 48.0 ± 6                    |
| DD7 bottom dup | 3                   | 3.36  | 14.5                      | 30.92                                   | 0.000450 ± 19                          | 147.1 ± 1.1        | 42.7 ± 2  | 40.0 ± 5                    |



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## Conclusions

High-resolution U-series dating indicates that *D. dianthus* typically lives for 40-50 years in the Chilean fjords before succumbing to the effects of bioerosion, which leads to the collapse of their skeletons. Environmental factors controlling ichnocoenosis thus plays an important role in the longevity of *D. dianthus*.