Proposal 716-Full2

Drowned coral reefs around Hawai’I

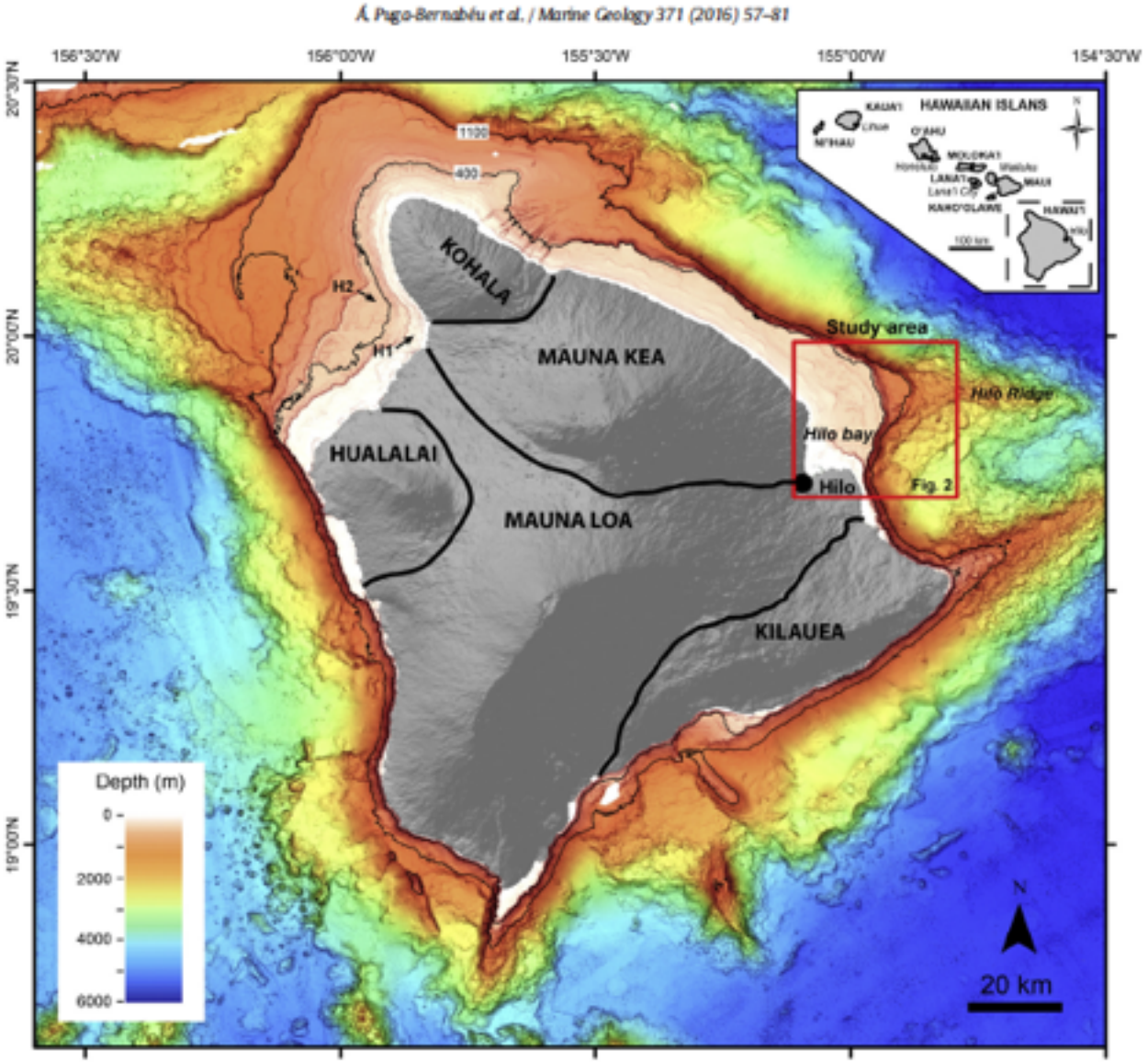
- Background
- Status

Coral Reefs and Sea-level

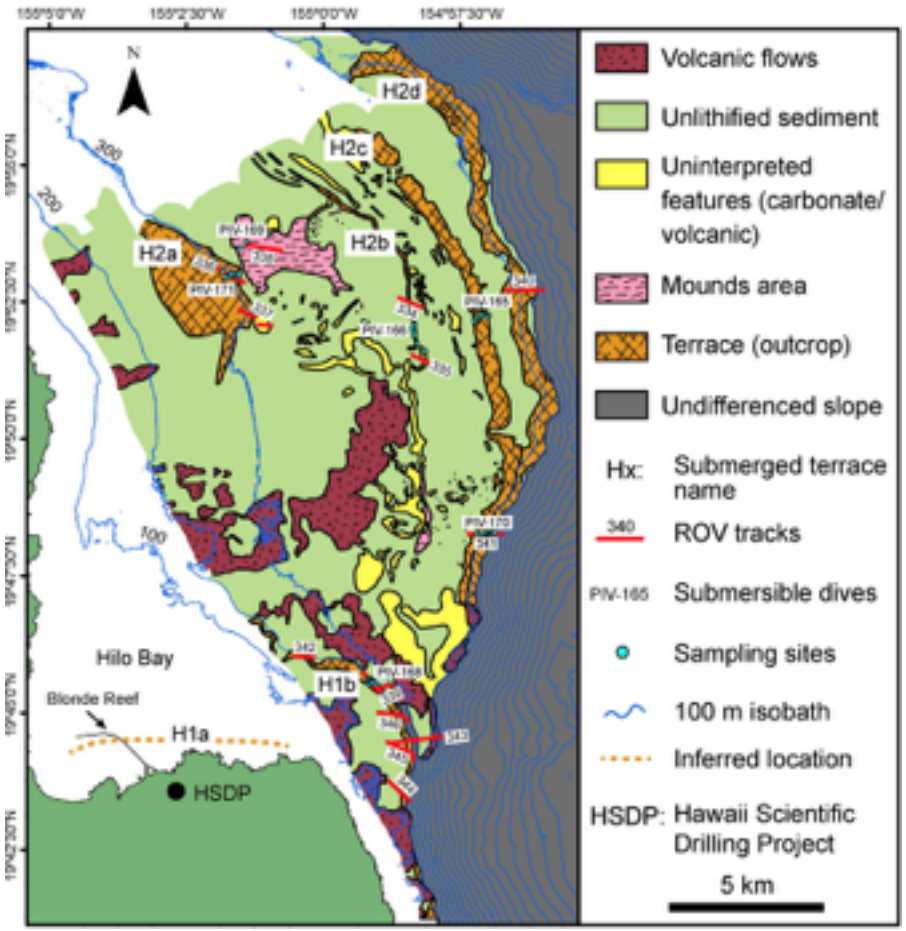
Great Barrier Reef (AUS)
"Stable"

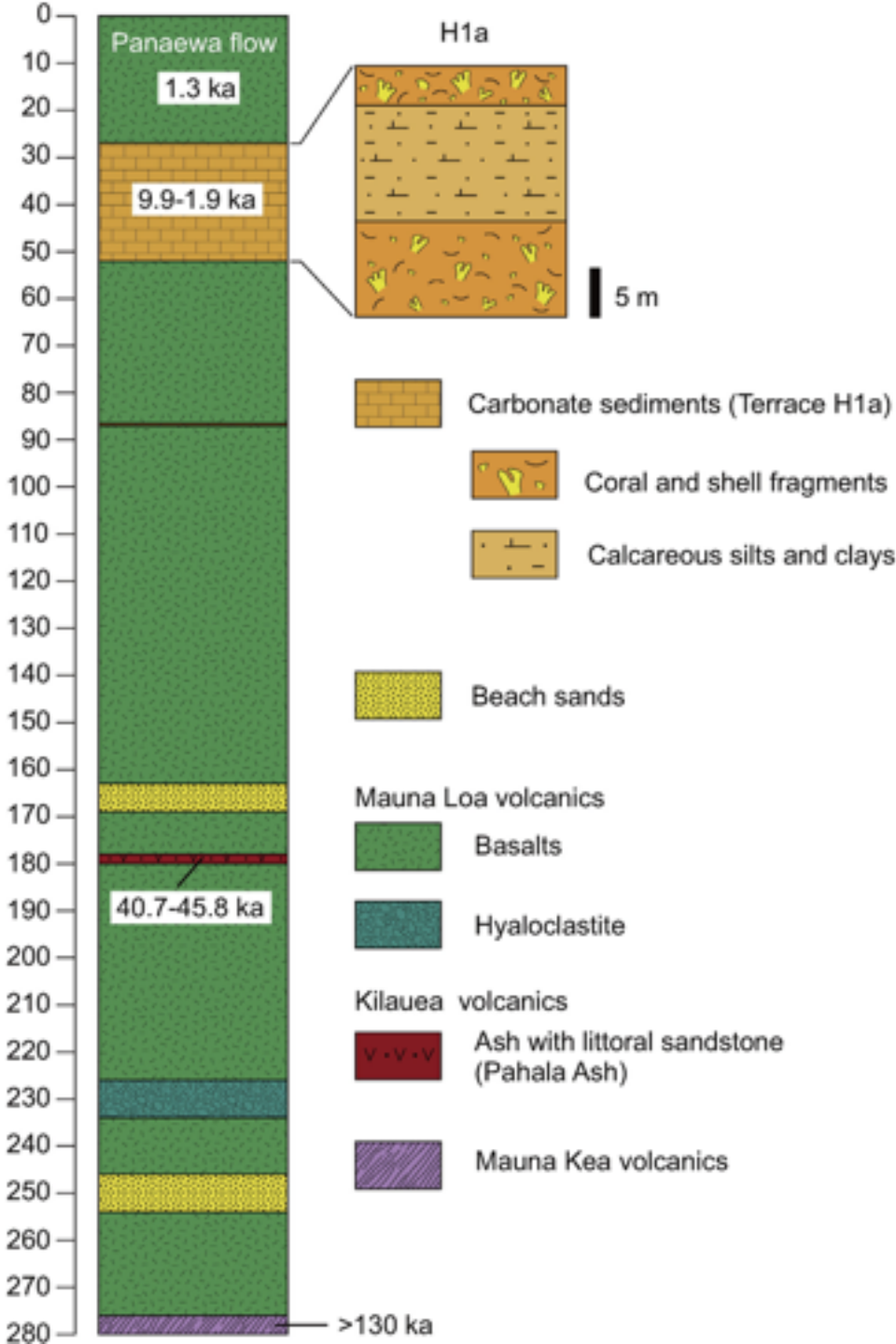
Huon Peninusla (PNG)
"Uplifted"

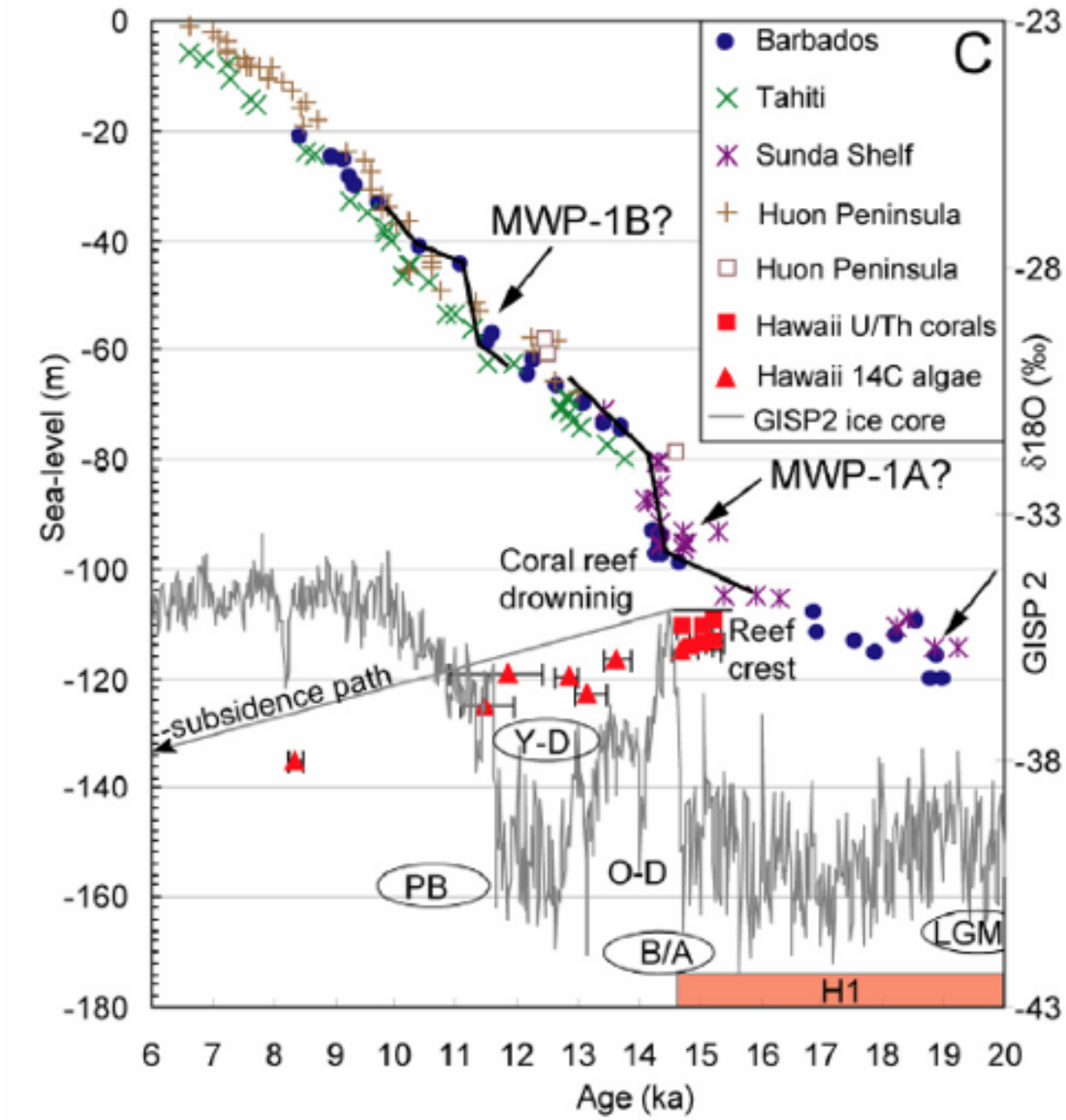
Hawai'i
"Subsided"

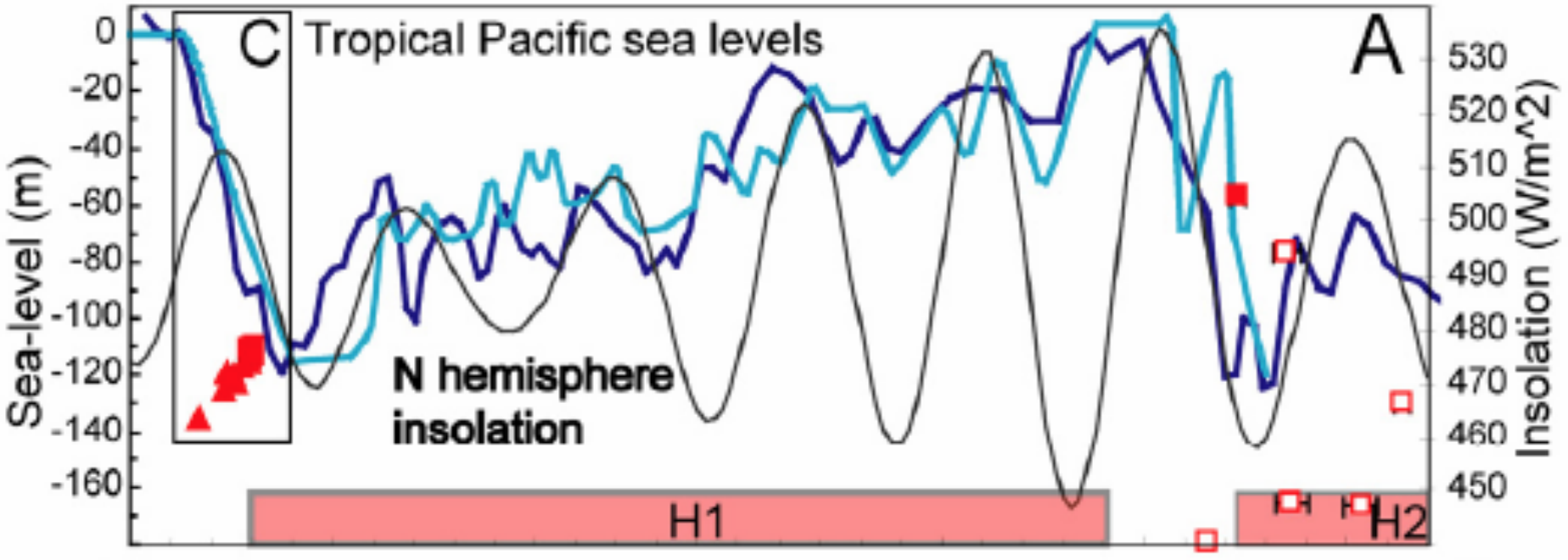


Hawai'ian Scientific Drilling Site (Hilo Drill core)

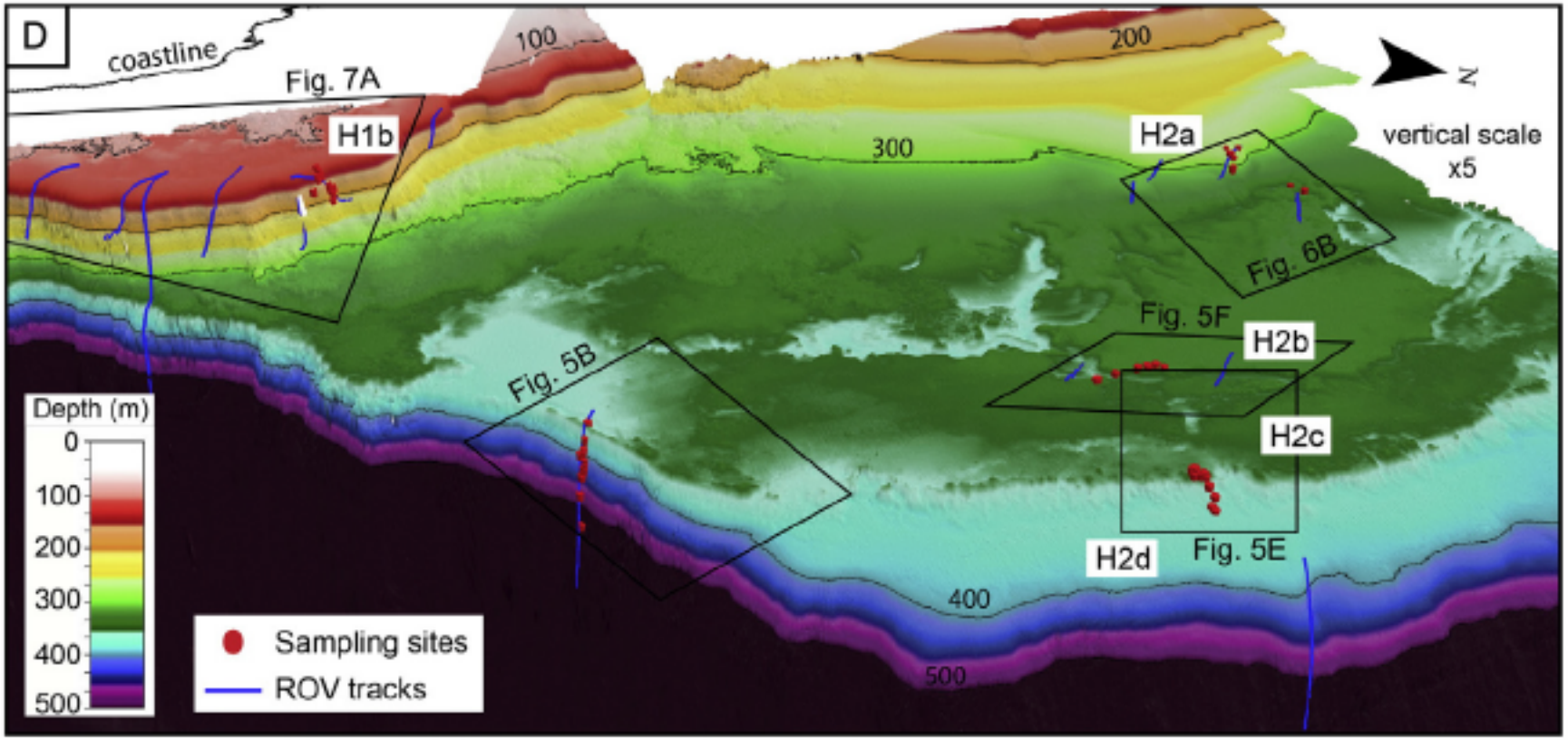





C
Barbados
Tahiti
Sunda Shelf
Huon Peninsula
Huon Peninsula
Hawaii U/Th corals
Hawaii 14C algae
GISP2 ice core
MWP-1B?
MWP-1A?
Coral reef
drowninig
Reef
crest
subsidence path
Y-D
PB
O-D
B/A
H1
LGM
Sea-level (m)
δ18O (‰)
GISP 2
Age (ka)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-23
-28
-33
-38
-43
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20


C
Tropical Pacific sea levels
A
Sea-level (m)
0
-20
-40
-60
-80
-100
-120
-140
-160
Insolation (W/m^2)
530
520
510
500
490
480
470
460
450
N hemisphere
insolation
H1
H2

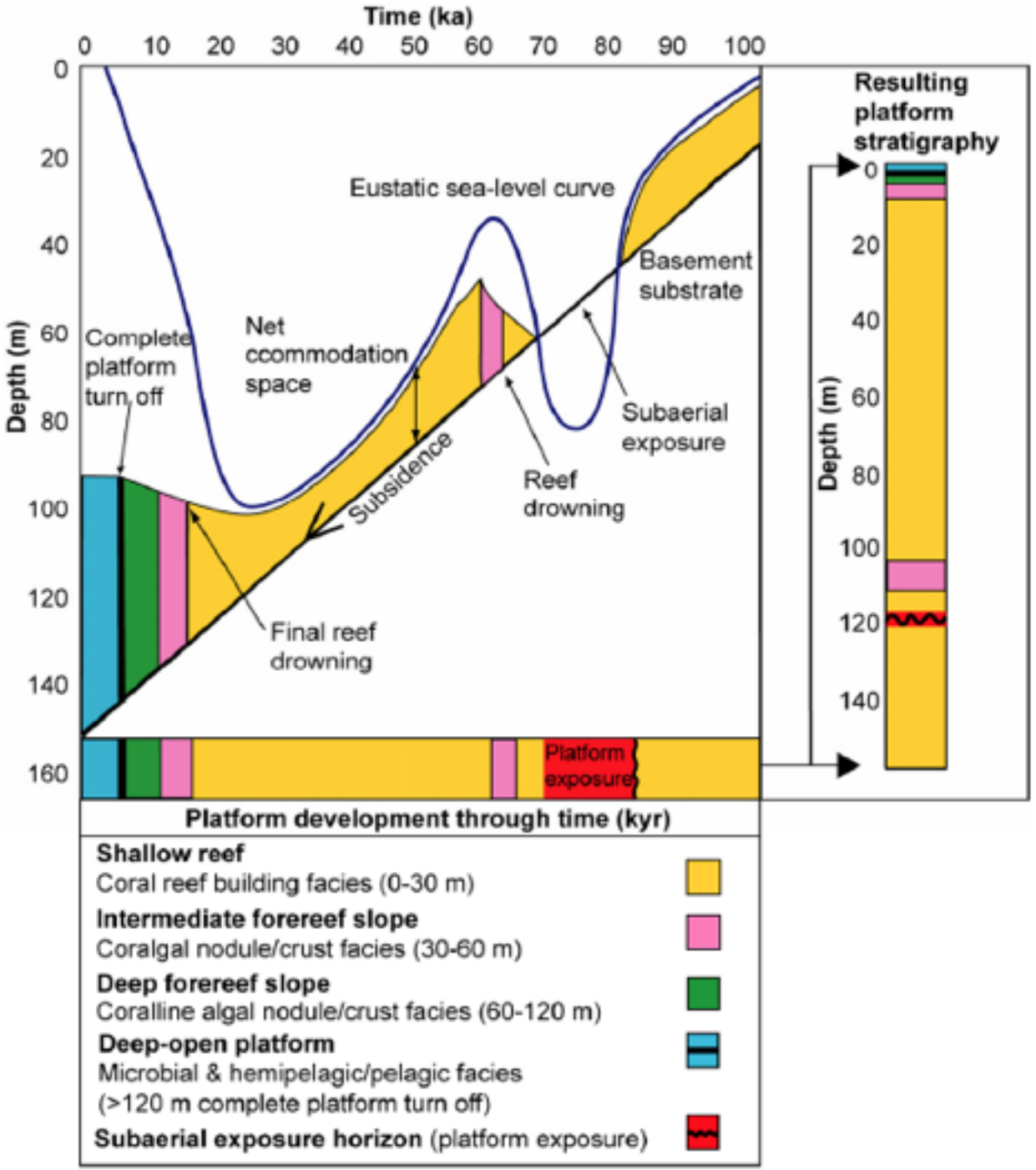
Formation of Reef Terraces



Subsiding Reefs: Advantages and Differences:

- Different intervals of sea-level
  -- Especially regression and rapid rises.

- Less diagenesis (e.g., for paleoclimate studies)


Time (ka)
0
10
20
30
40
50
60
70
80
90
100
Depth (m)
0
20
40
60
80
100
120
140
160
Eustatic sea-level curve
Basement substrate
Complete platform turn off
Net accommodation space
Subsidence
Subaerial exposure
Reef drowning
Final reef drowning
Platform exposure
Resulting platform stratigraphy
Depth (m)
0
20
40
60
80
100
120
140
Platform development through time (kyr)
Shallow reef
Coral reef building facies (0-30 m)
Intermediate forereef slope
Coralgal nodule/crust facies (30-60 m)
Deep forereef slope
Coralline algal nodule/crust facies (60-120 m)
Deep-open platform
Microbial & hemipelagic/pelagic facies
(>120 m complete platform turn off)
Subaerial exposure horizon (platform exposure)

Received 1 April 2008

IODP Proposal Cover Sheet

716-Full2

☐ **New** ☑ **Revised** ☐ **Addendum**

Please fill out information in all gray boxes

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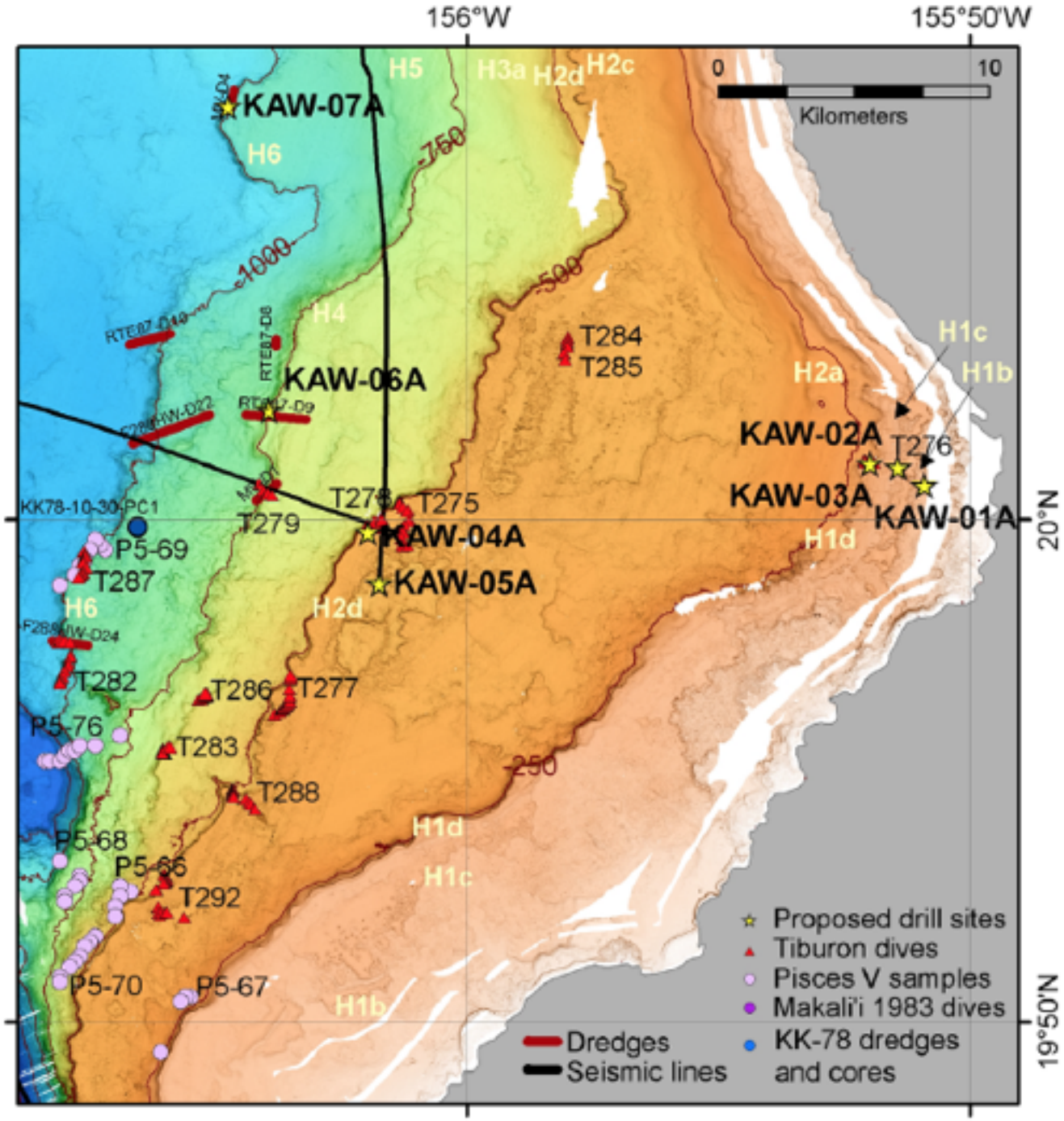
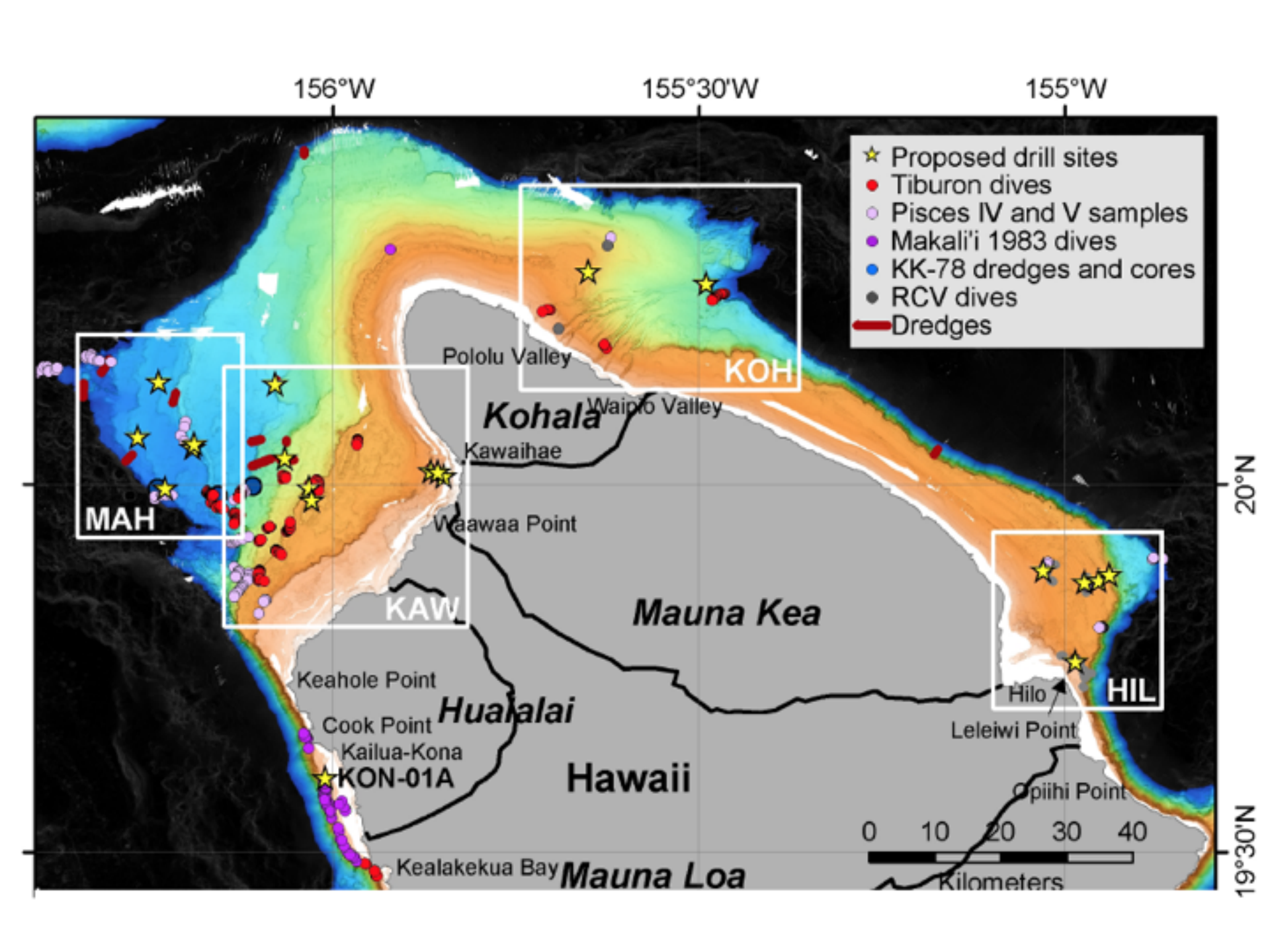
	Please check if this is Mission proposal ☐		
Title:	Drowned corals reefs around Hawaii: a unique archive of sea-level, climate change and reef response over the last 500 kyr		
Proponent(s):	J. M. Webster, A. C. Ravelo, C. Gallup, D. A. Clague, N. Allison, J. C. Braga, J. Chiang, C. Fletcher, E. Grossman, Y. Iryu, , J. Pandolfi, W. Renema, Y. Yokoyama, C. Vasconcelos, R. Warthmann, S. P. Templer		
Keywords: *(5 or less)*	climate change, sea level, coral reef response, geomicrobiology, central Pacific,	Area:	Central Pacific Ocean; Hawaii

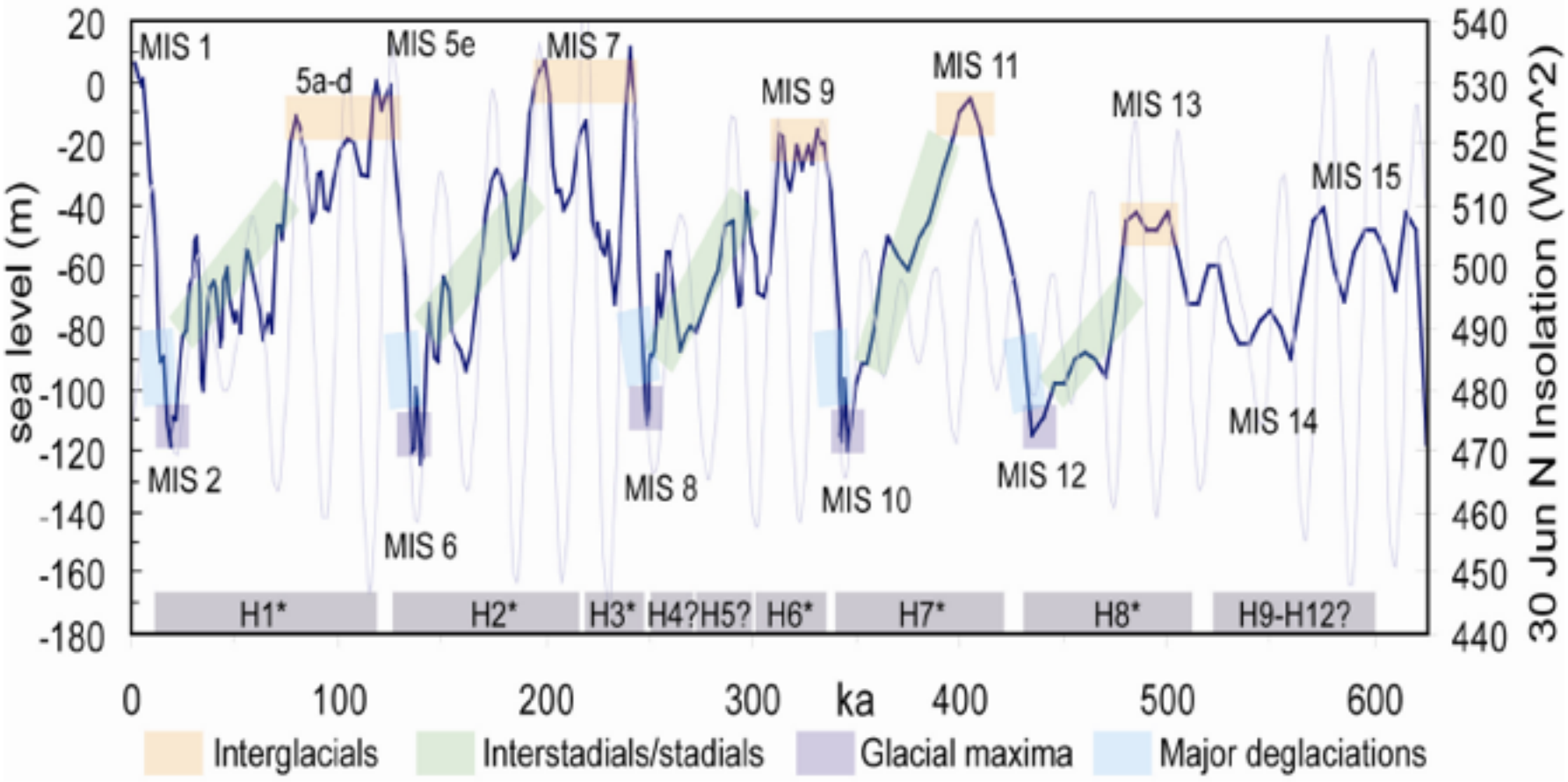


Reef Terraces

*relatively flat areas

* 13 identified around Hawaii


156°W
155°30'W
155°W
20°N
19°30'N
Proposed drill sites
Tiburon dives
Pisces IV and V samples
Makali'i 1983 dives
KK-78 dredges and cores
RCV dives
Dredges
KOH
MAH
KAW
HIL
Pololu Valley
Waipio Valley
Kohala
Kawaihae
Waawaa Point
Mauna Kea
Keahole Point
Hualalai
Cook Point
Kailua-Kona
KON-01A
Hawaii
Hilo
Leleiwi Point
Opiihi Point
Kealakekua Bay
Mauna Loa
0 10 20 30 40
Kilometers


sea level (m)
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
30 Jun N Insolation (W/m^2)
540
530
520
510
500
490
480
470
460
450
440
MIS 1
5a-d
MIS 5e
MIS 7
MIS 9
MIS 11
MIS 13
MIS 15
MIS 2
MIS 6
MIS 8
MIS 10
MIS 12
MIS 14
H1*
H2*
H3*
H4?H5?
H6*
H7*
H8*
H9-H12?
0
100
200
300
ka
400
500
600
Interglacials
Interstadials/stadials
Glacial maxima
Major deglaciations

Drill Hawaiian reef terraces for four goals:

1) Detailed sea-level history (last 500 kyr)

2) High-resolution Paleoclimate of central Pacific (last 500 kyr)

3) Response of reefs to rapid environmental (sea-level) changes

4) To better constrain Hawaiian subsidence (**)

Proposed Sites:

Site Name	Position	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
Primary						
KON-01A	19.600341N, -156.010975W	-145	140	10	150	H1d reef that spans MIS 1-5 (leeward, dry)
KAW-03A	20.018587N, -155.866458W	-154	140	10	150	H1d reef that spans MIS 1-5 (leeward, dry)
KAW-04A	19.995815N, -156.032933W	-419	140	10	150	H2d reef that spans MIS 6-7 (leeward, dry)
KAW-06A	20.036417N, -156.065696W	-737	140	10	150	H4 reef that spans MIS 8-9 (leeward, dry)
KAW-07A	20.137266N, -156.079341W	-988	140	10	150	H6 reef that spans MIS 10-11 (leeward, dry)
MAH-01A	20.055411N, -156.189697W	-1102	140	10	150	H8a reef that spans MIS 12-13 (leeward, dry)
MAH-02A	20.050262N, -156.192035W	-1154	140	10	150	H8b reef that spans MIS 12-13 (leeward, dry))
KOH-01A	20.290268N, -155.651218W	-410	140	10	150	H2d reef that spans MIS 6-7 (windward, wet)
KOH-02A	20.273958N, -155.490294W	-930	140	10	150	H7 reef that spans MIS 10-11 (windward, wet)
HIL-01A	19.758805N, -154.985708W	-134	140	10	150	H1d reef that spans MIS 1-5 (windward, wet)
HIL-05A	19.876999N,-154.939618W	-402	140	110	150	H2d reef that spans MIS 6-7 (windward, wet)
Alternate						
KAW-01A	20.011332N, -155.848480W	-109	140	10	150	H1b reef that spans MIS 1-5 (leeward, dry)
KAW-02A	20.017325N, -155.857206W	-131	140	10	150	H1c reef that spans MIS 1-5 (leeward, dry)
KAW-05A	19.978715N, -156.029159W	-466	140	10	150	H2d reef that spans MIS 6-7 (leeward, dry)
HIL-02A	19.883005N, -155.029932W	-271	140	10	150	H2a reef that spans MIS 4?-7 (windward, wet)
HIL-03A	19.867141N, -154.973387W	-338	140	10	150	H2b reef that spans MIS 5a?-7 (windward, wet)
HIL-04A	19.869407N, -154.954576W	-354	140	10	150	H2c reef that spans MIS 5a?-7 (windward, wet)
MAH-03A	20.140405N, -156.238194W	-1213	140	10	150	H9 reef that spans MIS 14-15? (leeward, dry)
MAH-04A	20.065165N, -156.266945W	-1234	140	10	150	H10 reef that spans MIS 14-15? (leeward, dry)
MAH-05A	19.994893N, -156.229296W	-1289	140	10	150	H11 reef that spans MIS 14-15? (leeward, dry)

Proposal Status:

In the “holding-bin” since 2012.

High-priority and very good reviews. Well-received by SEP (but in 2008!) and the EFB.

Issue is money and technology.

A “mid-cost proposal”.

Possibly 2019/2020? Does it need renewed review?

No new addendums* BUT …

Update (since 2015):

- Location and examination of old PROD drilling cores from subsiding reef terraces on NE Australia (successful)
- Compendium of bathymetry
- Dating of shallow “grab” samples on southeast Hawai’i (radiocarbon and U-series)
- Possibility of Amphibious (given Hilo Drill core).