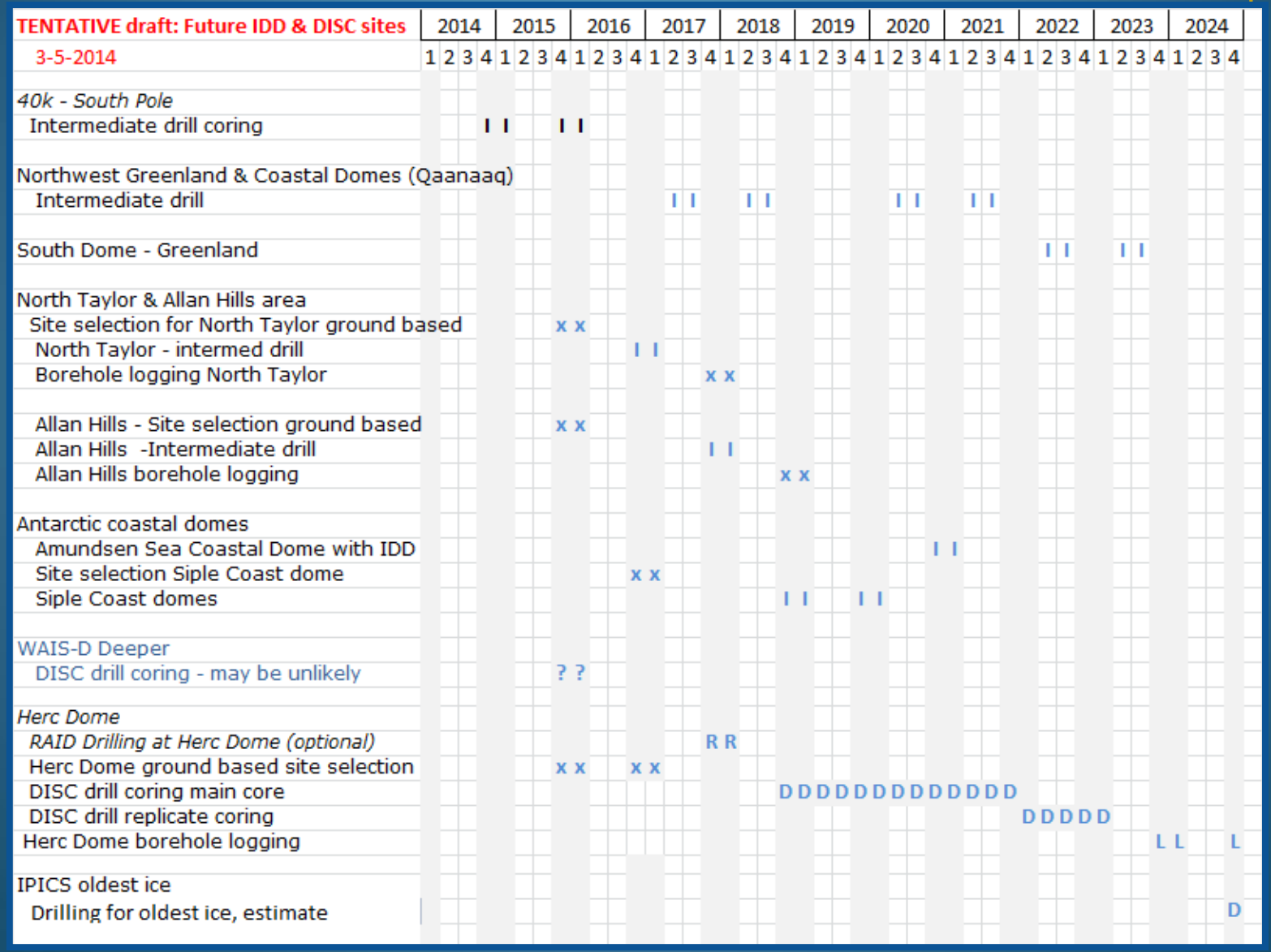
Ice Drilling Program Office
Draft ICWG Matrix for SAB-LRSP



TENTATIVE draft: Future IDD & DISC sites	2014				2015				2016				2017				2018				2019				2020				2021				2022				2023				2024			
3-5-2014	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
40k - South Pole																																												
Intermediate drill coring					I	I				I	I																																	
Northwest Greenland & Coastal Domes (Qaanaaq)																																											
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South Dome - Greenland																																		I	I			I	I					
North Taylor & Allan Hills area																																											
Site selection for North Taylor ground based										x	x																																
North Taylor - intermed drill													I	I																													
Borehole logging North Taylor																x	x																										
Allan Hills - Site selection ground based										x	x																																
Allan Hills -Intermediate drill																I	I																										
Allan Hills borehole logging																					x	x																					
Antarctic coastal domes																																											
Amundsen Sea Coastal Dome with IDD																														I	I												
Site selection Siple Coast dome													x	x																													
Siple Coast domes																						I	I			I	I																
WAIS-D Deeper																																											
DISC drill coring - may be unlikely										?	?																																
Herc Dome																																											
RAID Drilling at Herc Dome (optional)																R	R																										
Herc Dome ground based site selection										x	x			x	x																												
DISC drill coring main core																					D	D	D	D	D	D	D	D	D	D	D	D										
DISC drill replicate coring																																	D	D	D	D	D						
Herc Dome borehole logging																																						L	L			L	
IPICS oldest ice																																											
Drilling for oldest ice, estimate																																										D	

Future Sites for Intermediate Depth Cores (1500m)

- North Taylor Dome
- Allen Hills Intermediate core
- Qaannaak
- Amundsen Sea Coastal Domes

Deep Drilling Target:
WAIS MIS5e climate record

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Eric Steig
Jeff Severinghaus
Tom Neumann

The Previous Interglacial

- 115 to 130 ka
- 0-2 ˚C warmer globally
- 3-5 ˚C warmer in polar regions
  - Peak in Greenland of 8±4 ˚C warmer at onset (NEEM, 2013)

Conditions similar to what is expected by 2100

The four IPICS science themes:

Oldest Ice

Why did glacial cycles switch from 40k to 100k around 1 Ma?

Last Interglacial

Best analog for our future. Did WAIS collapse?

40k Array

What was the spatial pattern of the climate system's response to a major forcing (the last deglaciation)?

2k Array

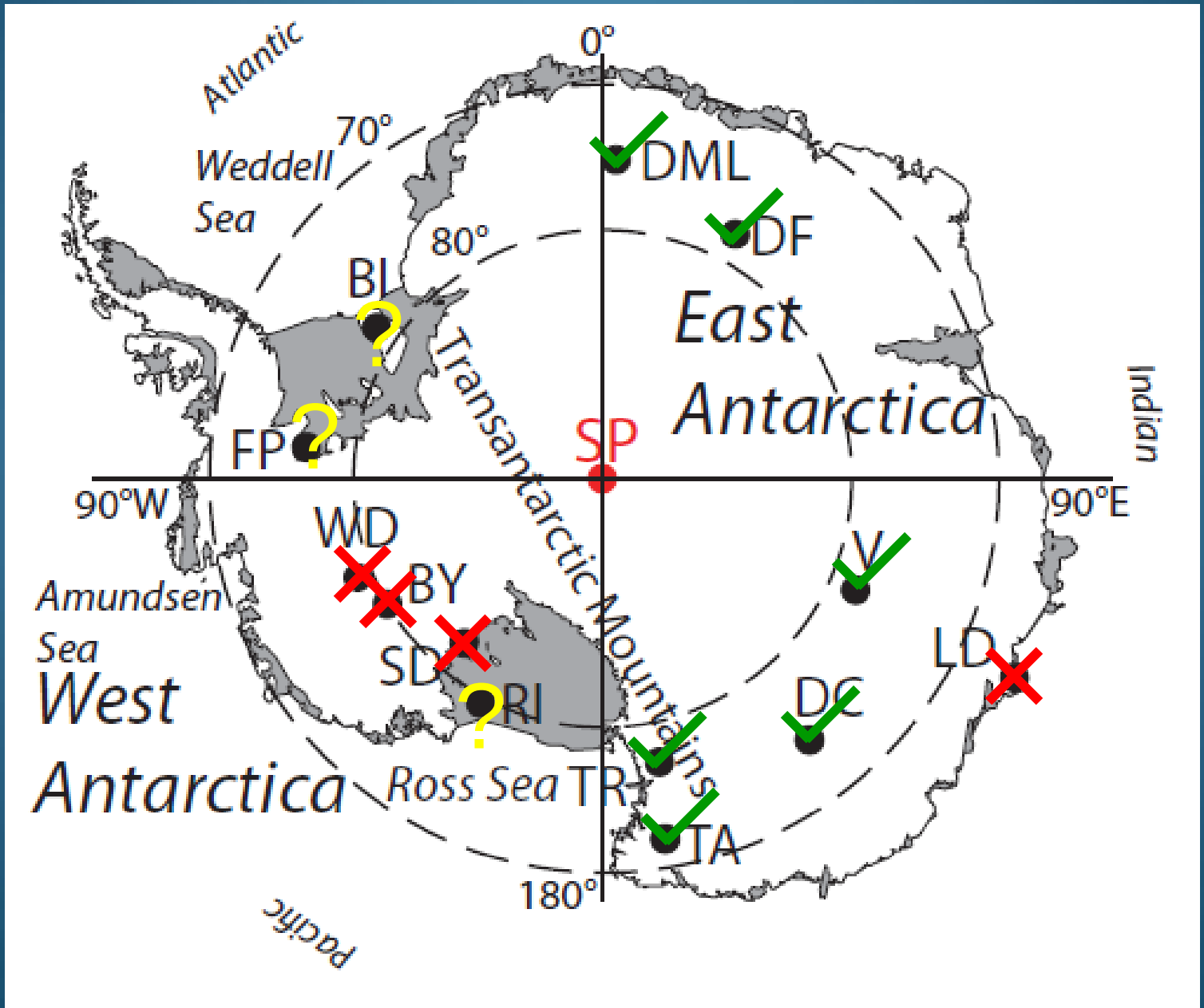
What is the spatial pattern of natural climate change, upon which anthropogenic change is superimposed?

Sea level during the previous interglacial

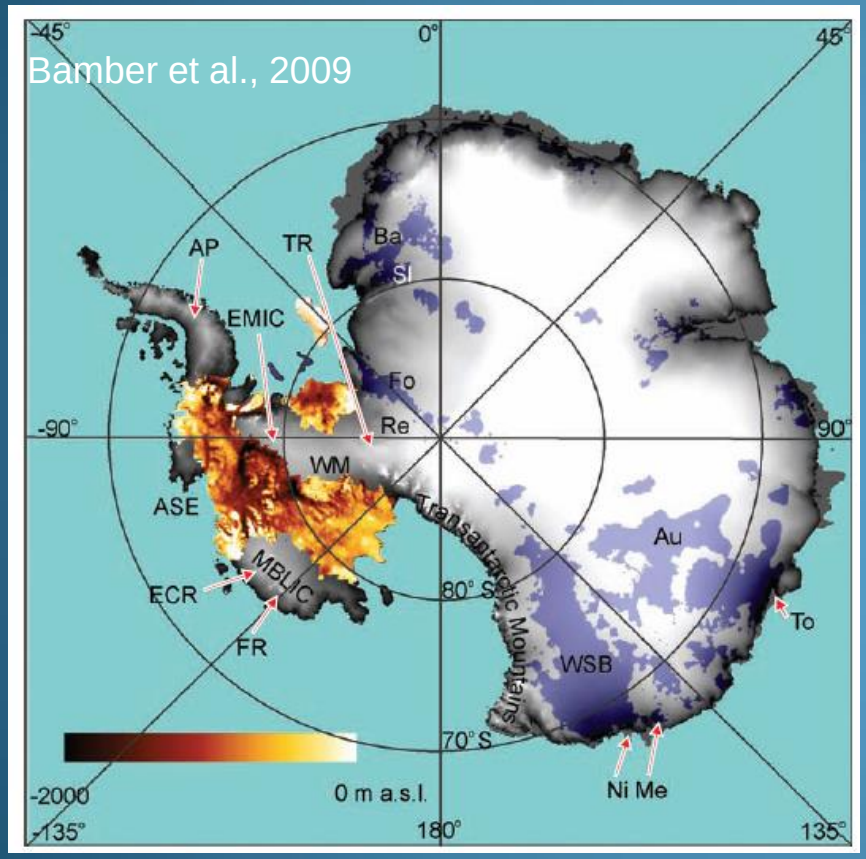
- Likely ~6 higher (Kopp et al., 2009)
- Maybe up to 9.5 m higher

Greenland contribution up to 4 m
Requires large Antarctic contribution
-WAIS collapse likely source

MIS5e Ice


Atlantic
0°
70°
Weddell Sea
80°
DML
DF
BI
East Antarctica
Transantarctic Mountains
Indian
FP
SP
90°W
90°E
WD
BY
V
Amundsen Sea
SD
LD
West Antarctica
RI
DC
Ross Sea
TR
TA
180°
Pacific

What site conditions are necessary for WAIS MIS5e climate record?



WAIS Configuration after collapse

-Stable Ice Flow

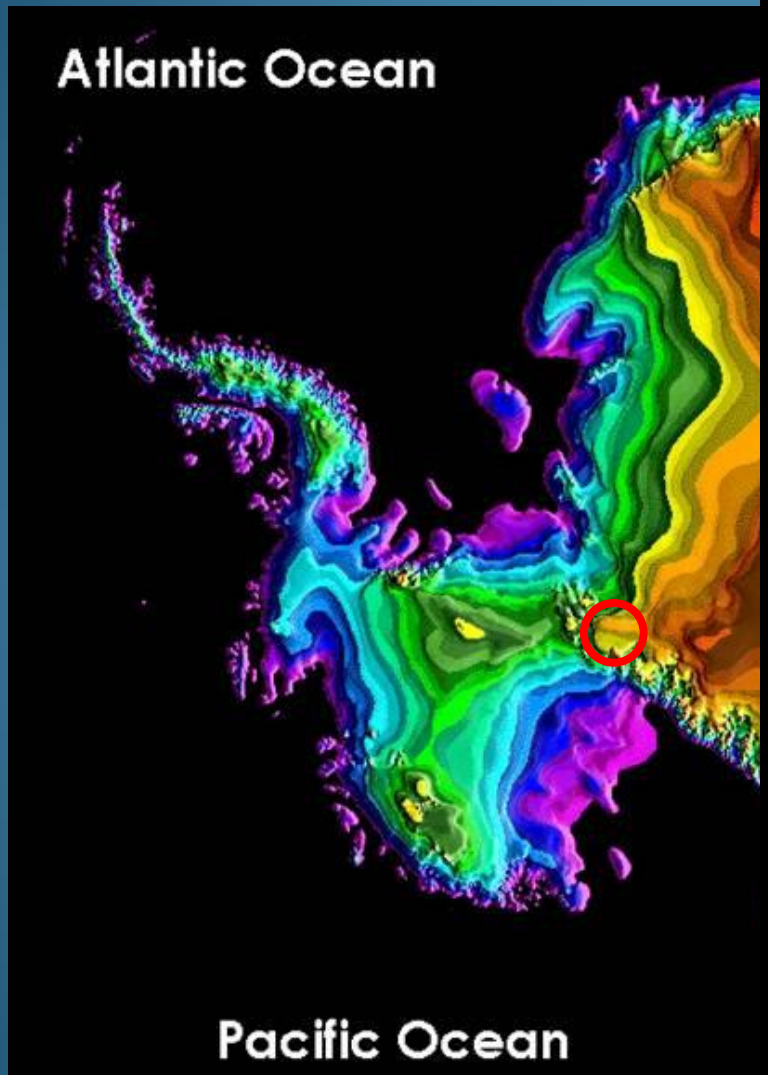
-Moderate Accumulation

-Deep Ice

-Little basal melt

Need site with signals of WAIS collapse but where the ice flow is not affected

Hercules Dome



West Antarctic influenced (although technically in East Antarctica)

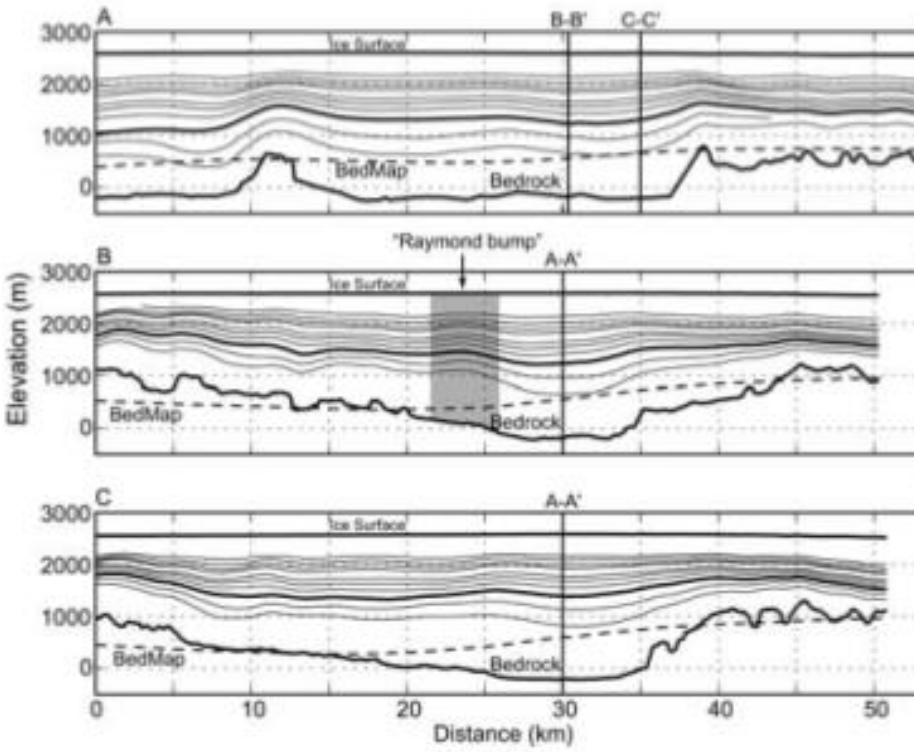
Deep ice (2800 m)

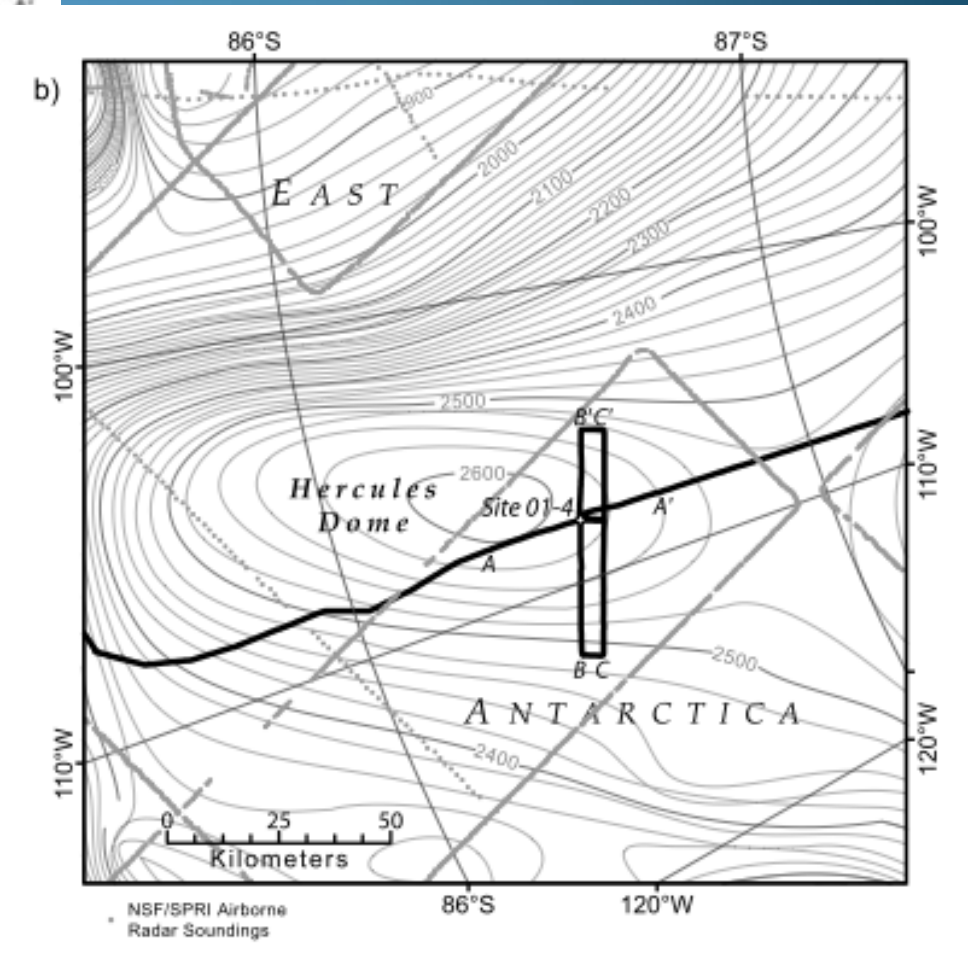
Moderate Accumulation (12 cm yr^{-1})

Likely stable flow and little basal melt (evidence of Raymond Bump)

Hercules Dome: Glaciological Setting

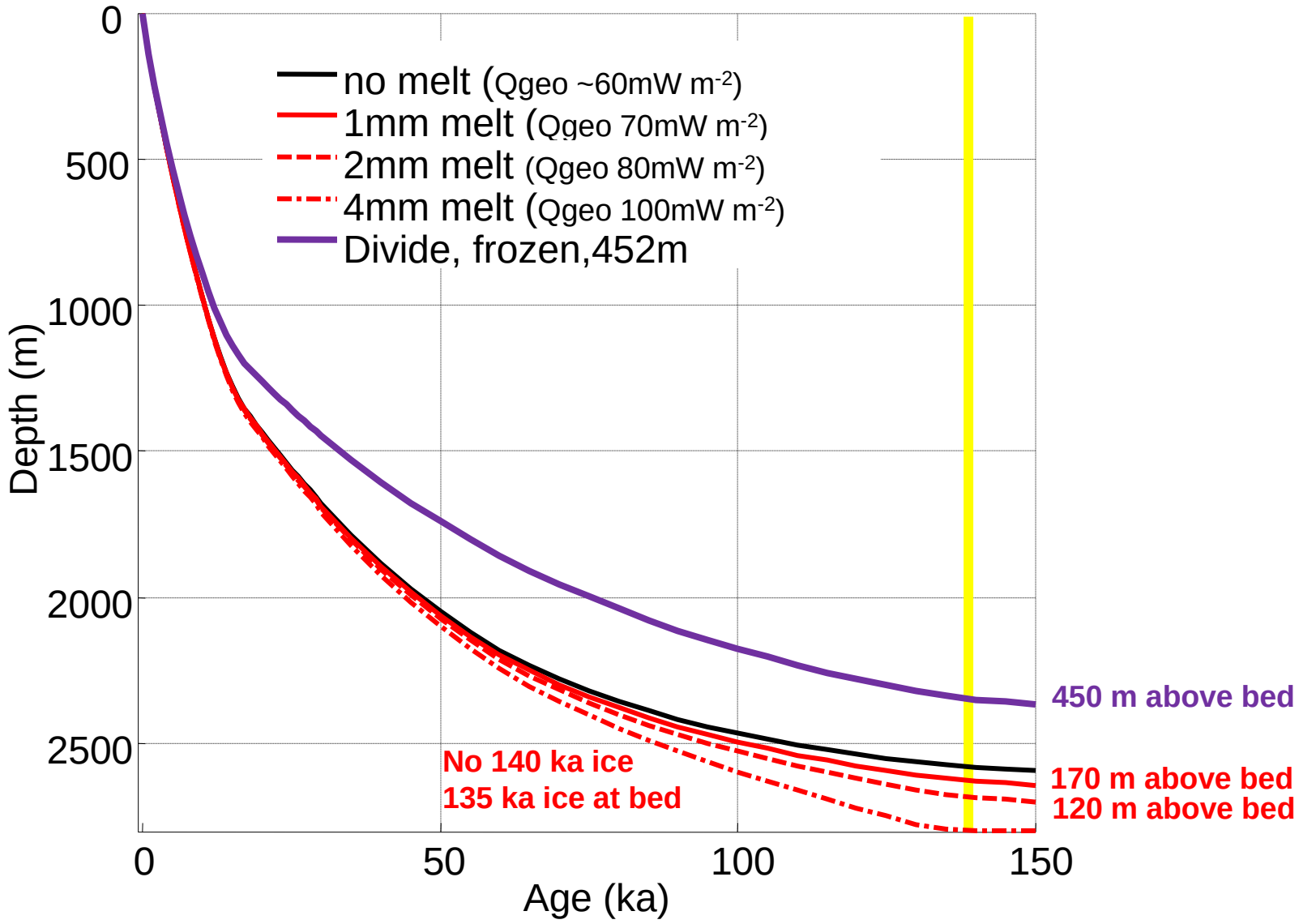
internal layers conformal with bed (a good thing).
some suggestion of a Raymond Bump.





Raymond Bump indicates frozen bed and stable ice flow

Jacobel et al. 2009


0
500
1000
1500
2000
2500
Depth (m)
0
50
100
150
Age (ka)
no melt (Qgeo ~60mW m-2)
1mm melt (Qgeo 70mW m-2)
2mm melt (Qgeo 80mW m-2)
4mm melt (Qgeo 100mW m-2)
Divide, frozen,452m
No 140 ka ice
135 ka ice at bed
450 m above bed
170 m above bed
120 m above bed

Project Schedule

- April 2014 – site selection proposal
- Summer 15/16 – large radar/GPS survey
  - If Raymond Bump confirmed, propose deep drilling in April 2016
- Summer 16/17 – detailed radar survey
  - Place X on map
- Summer 17/18 – establish field camp
- Summer 18/19 – deploy DISC drill, case firn
- Summer 19/20 – first season deep drilling, to 600m
- Summer 20/21 – second season deep drilling, to 1500 m
- Summer 21/22 – last season deep drilling, to 2600 m (bed)
- Summer 22/23 – replicate coring of MIS5e
- Summer 23/24 – borehole logging, remove DISC drill