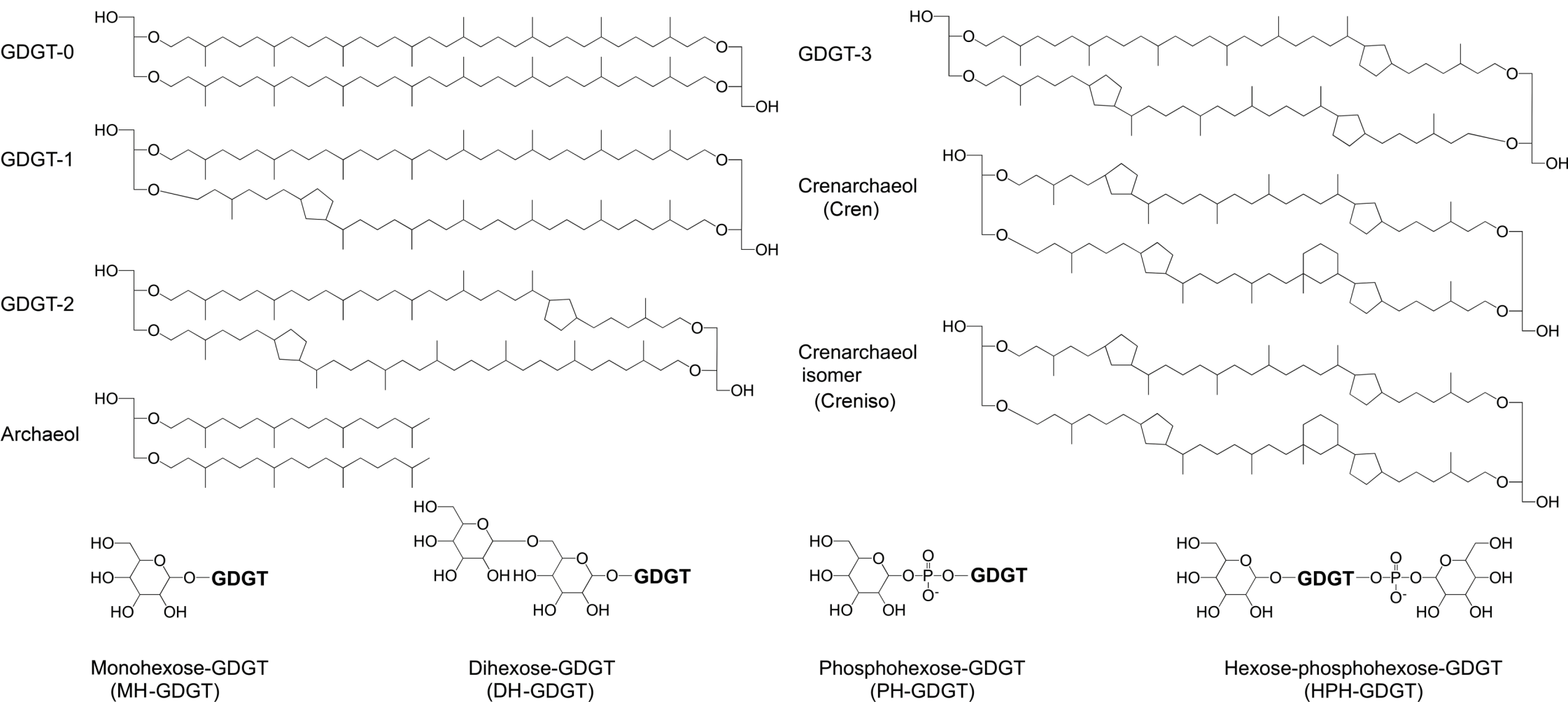
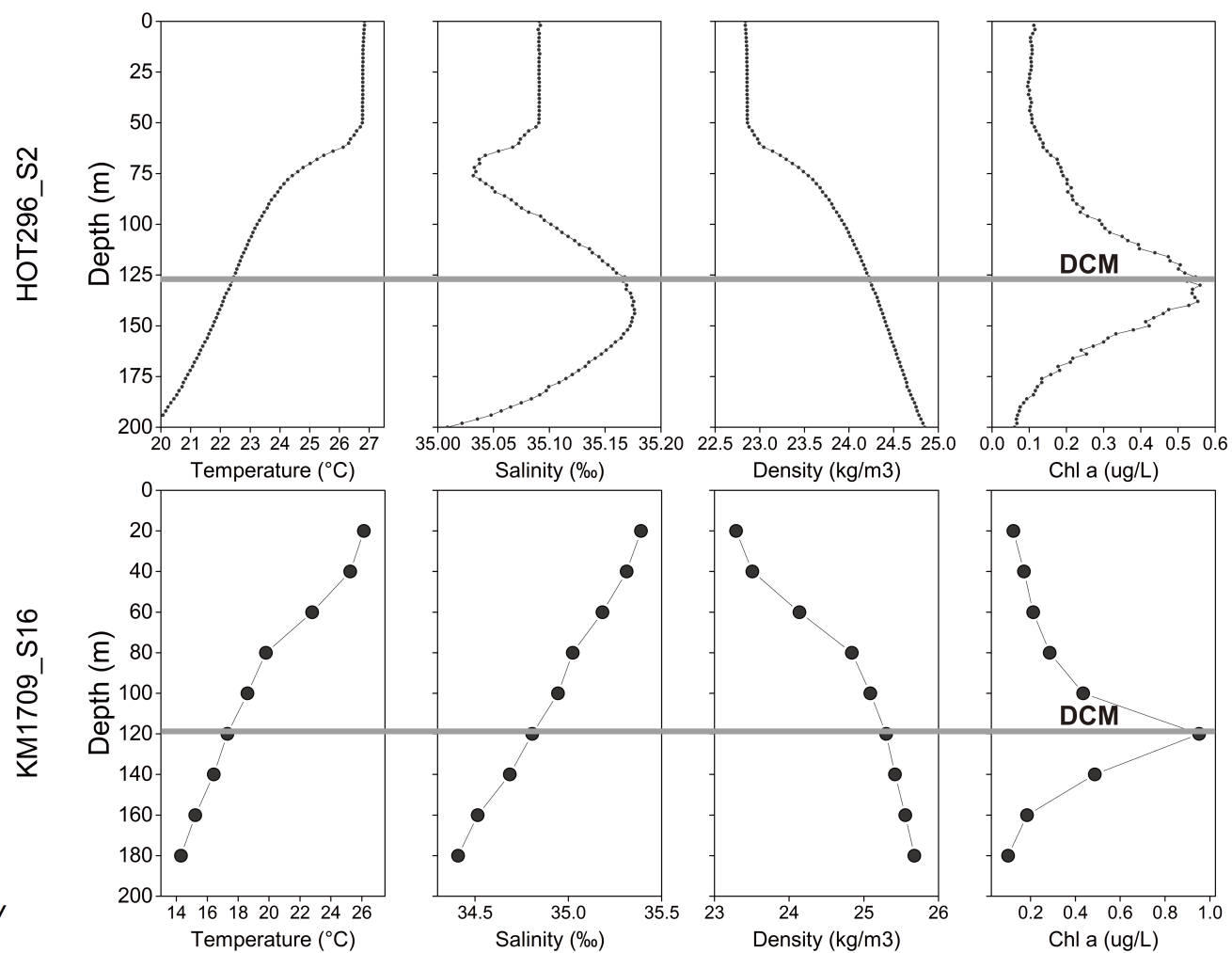
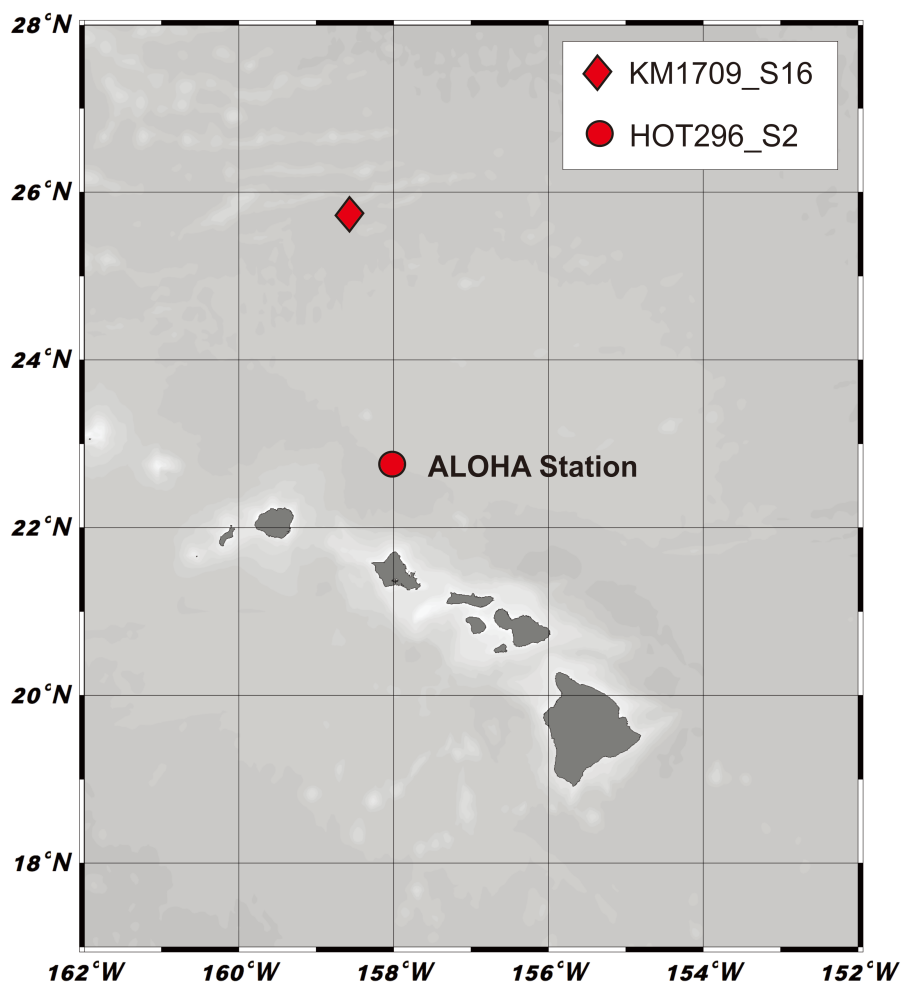


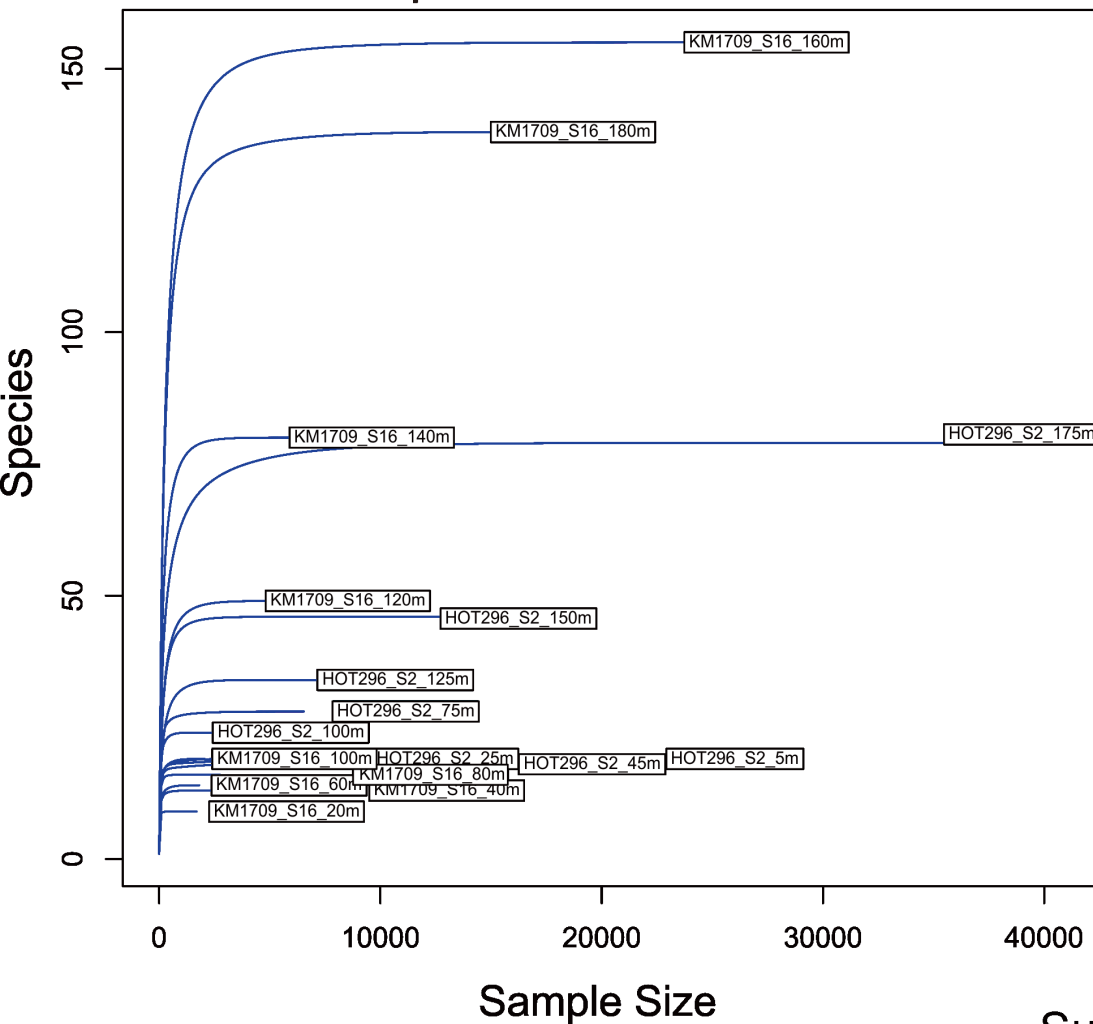


Supplementary Figure1. Structures of IP- and C-GDGTs

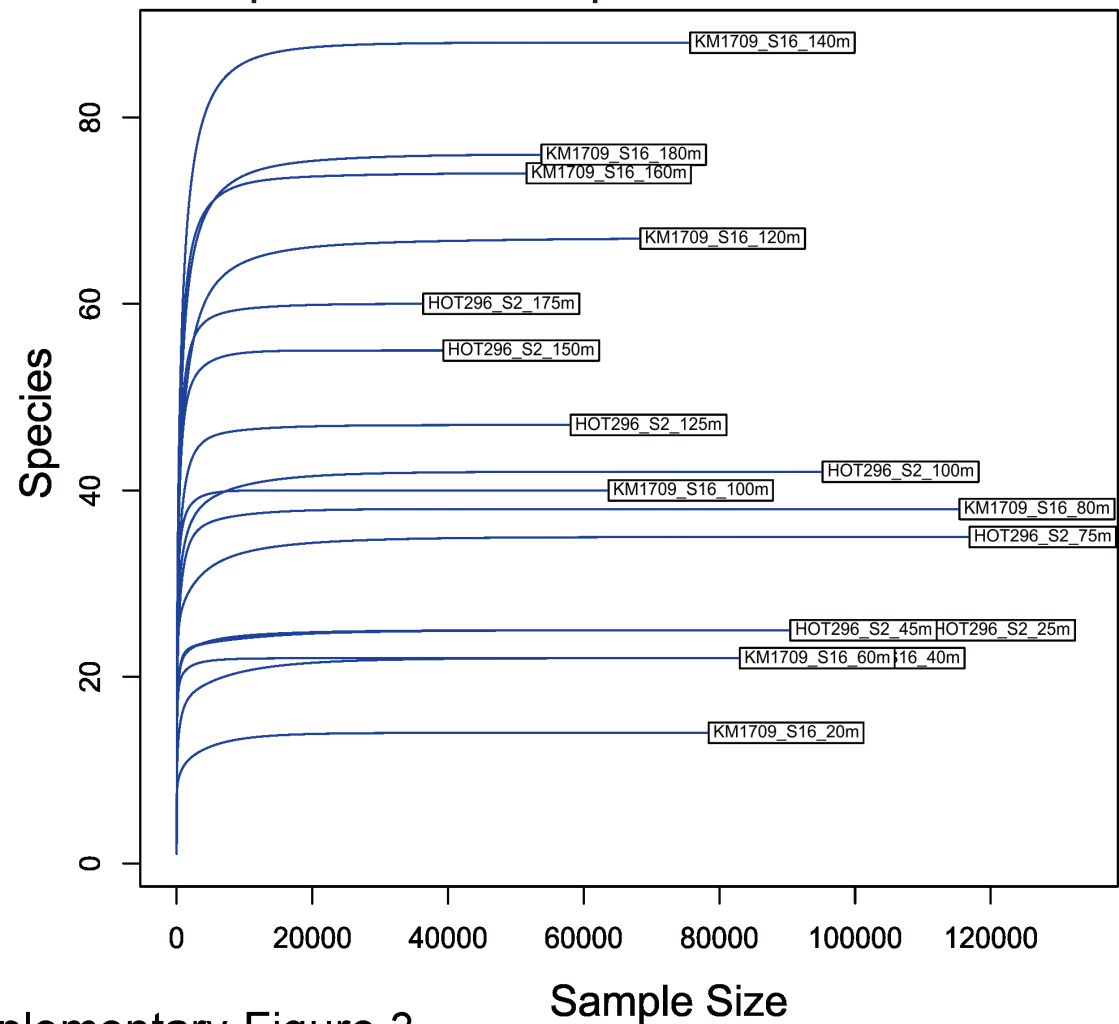


Supplementary Figure 2

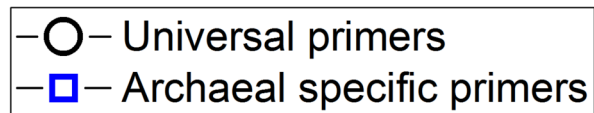
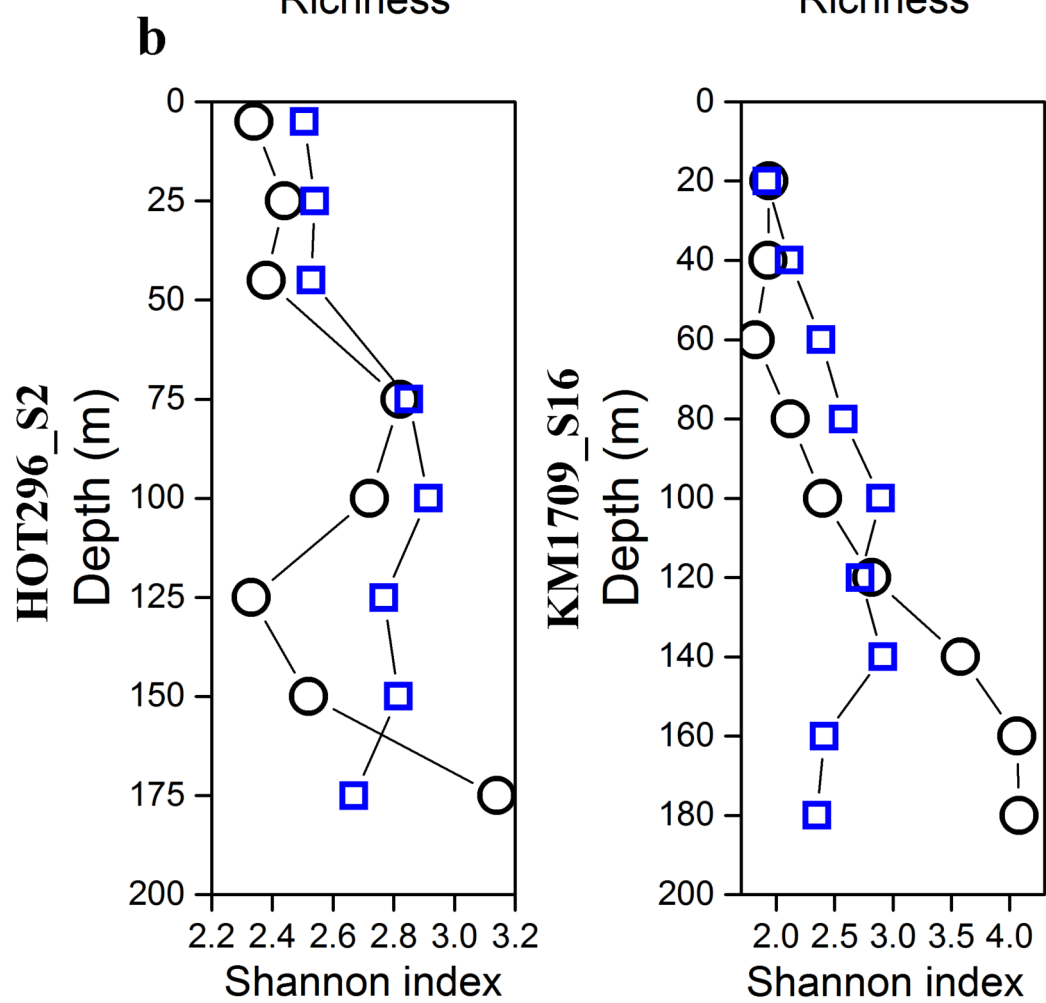
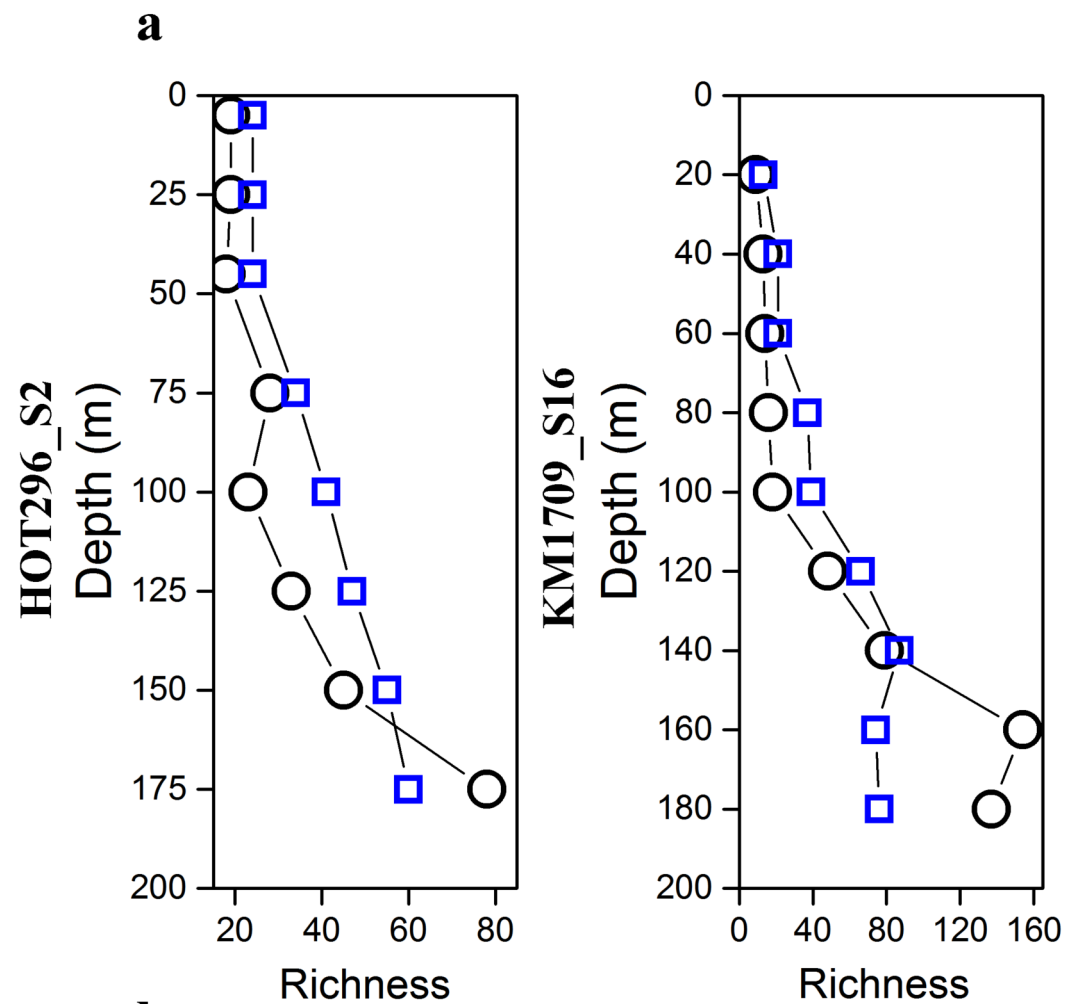
For universal primers



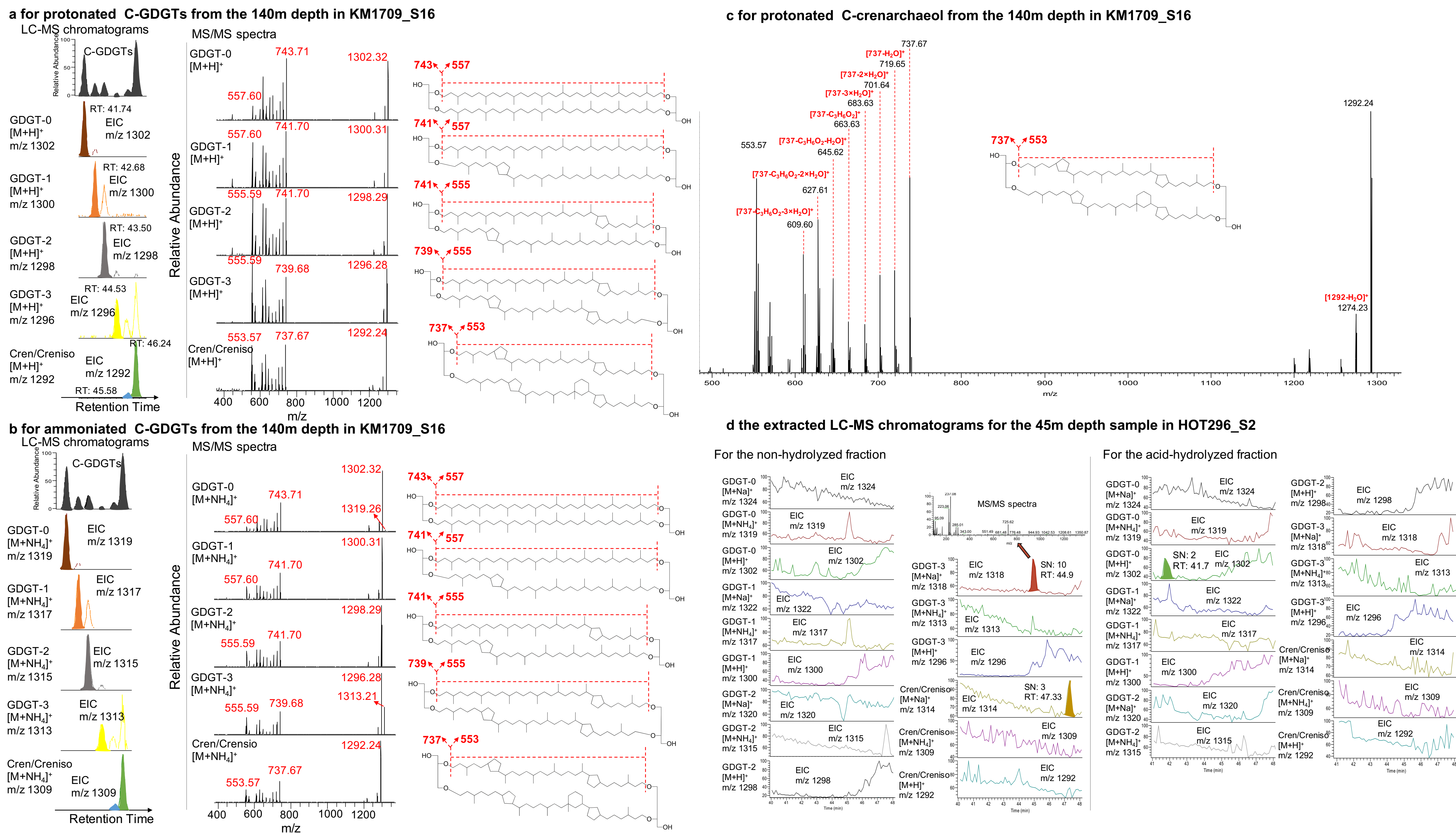
For specific archaeal primers



Supplementary Figure 3

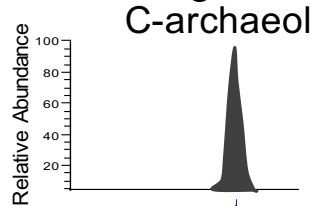


Supplementary Figure 4



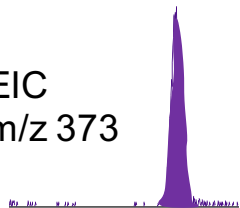
Supplementary Figure 5

LC-MS chromatograms



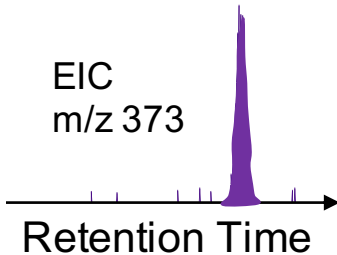
archaeol
[M+NH₄]⁺
m/z 670

EIC
m/z 373



archaeol
[M+H]⁺
m/z 653

EIC
m/z 373



MS/MS spectra

Relative Abundance

archaeol
[M+NH₄]⁺
m/z 670

373.37

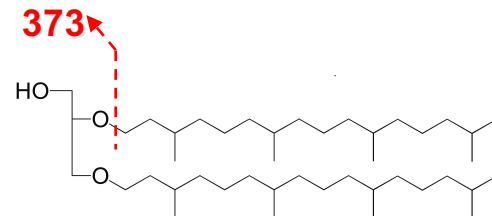
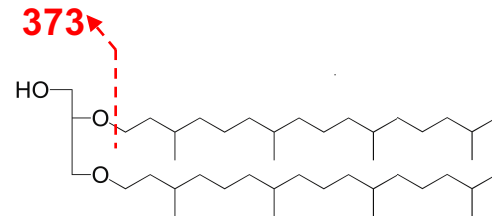
670.60

archaeol
[M+H]⁺
m/z 653

373.37

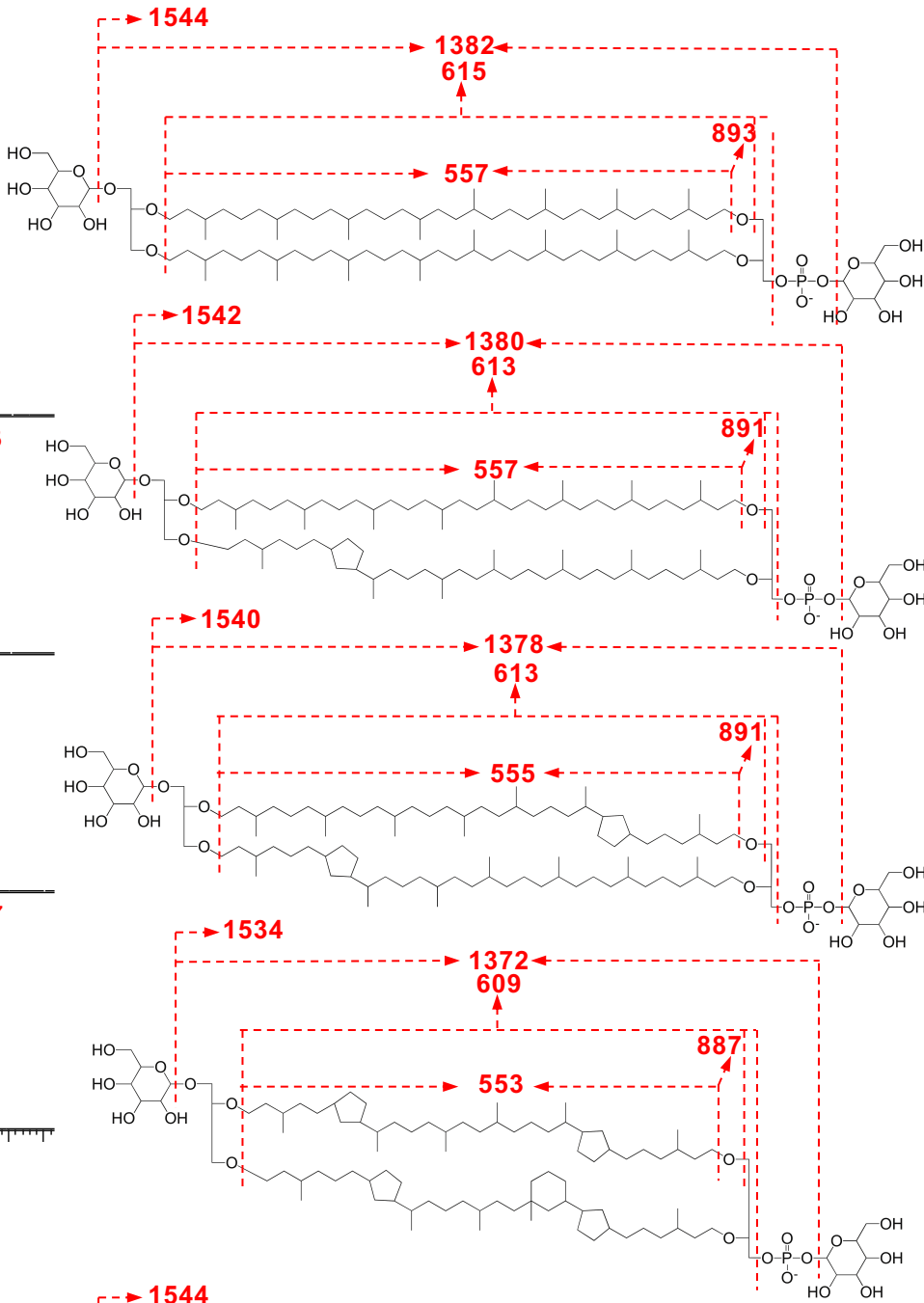
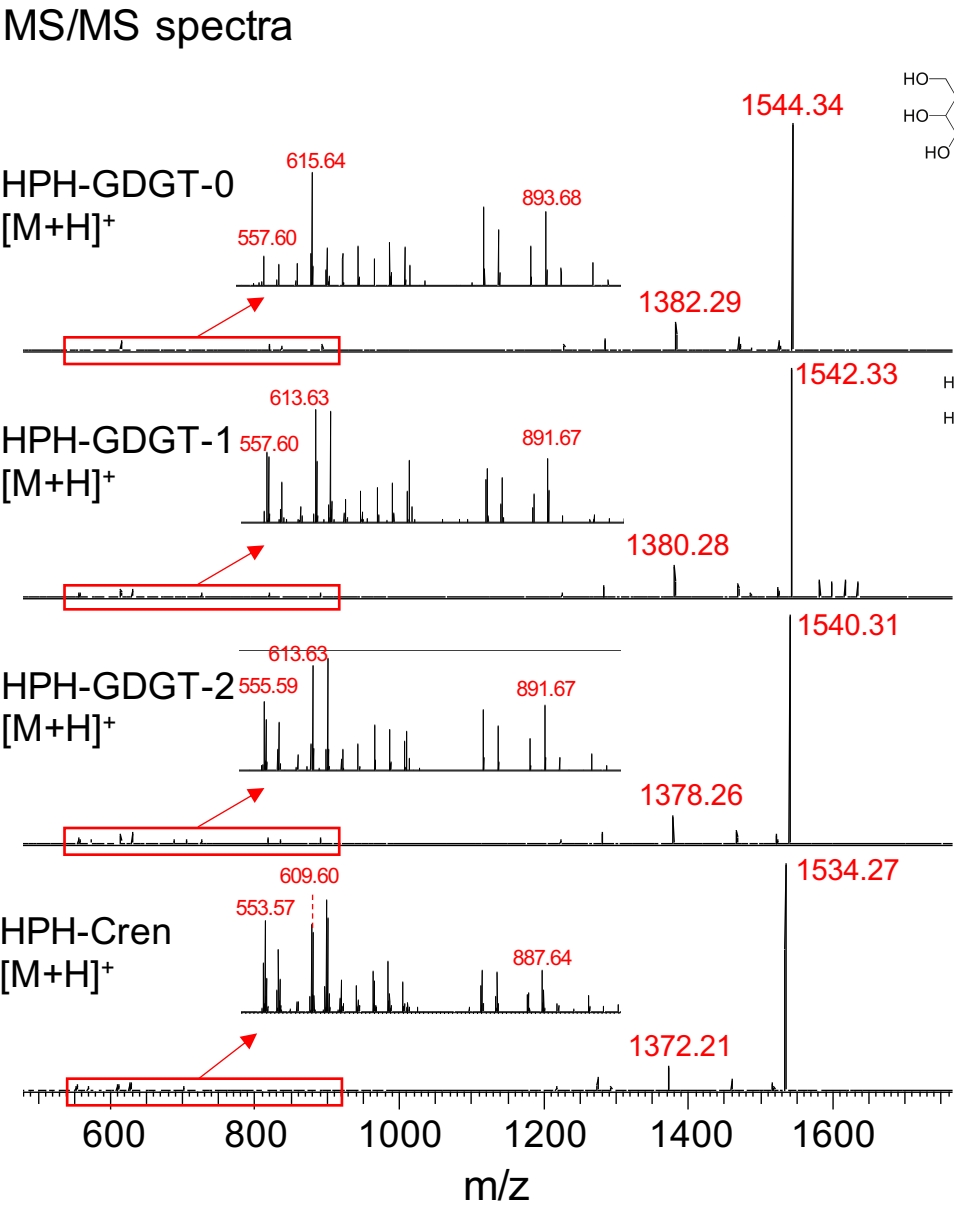
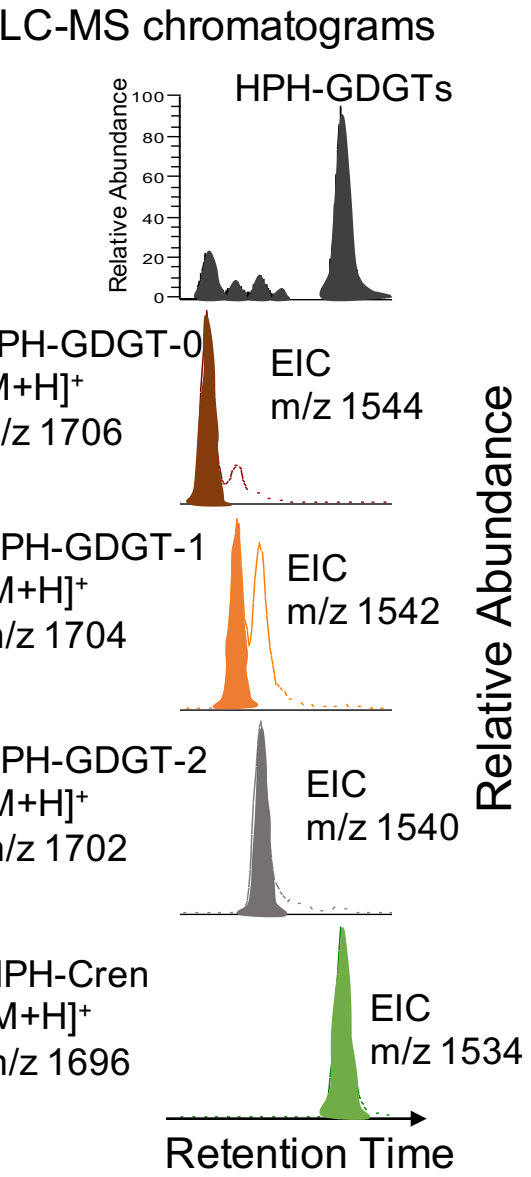
653.57

m/z

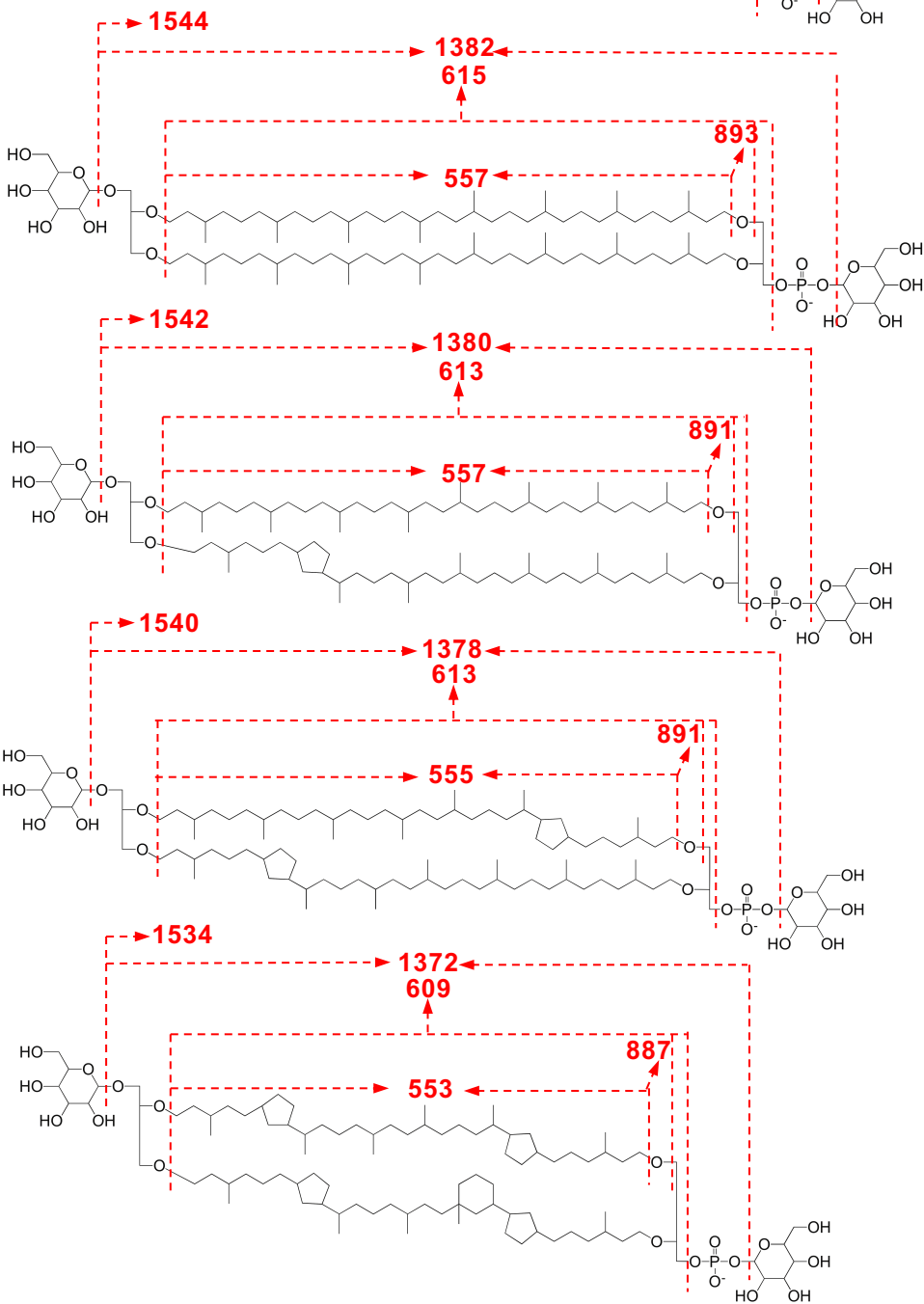
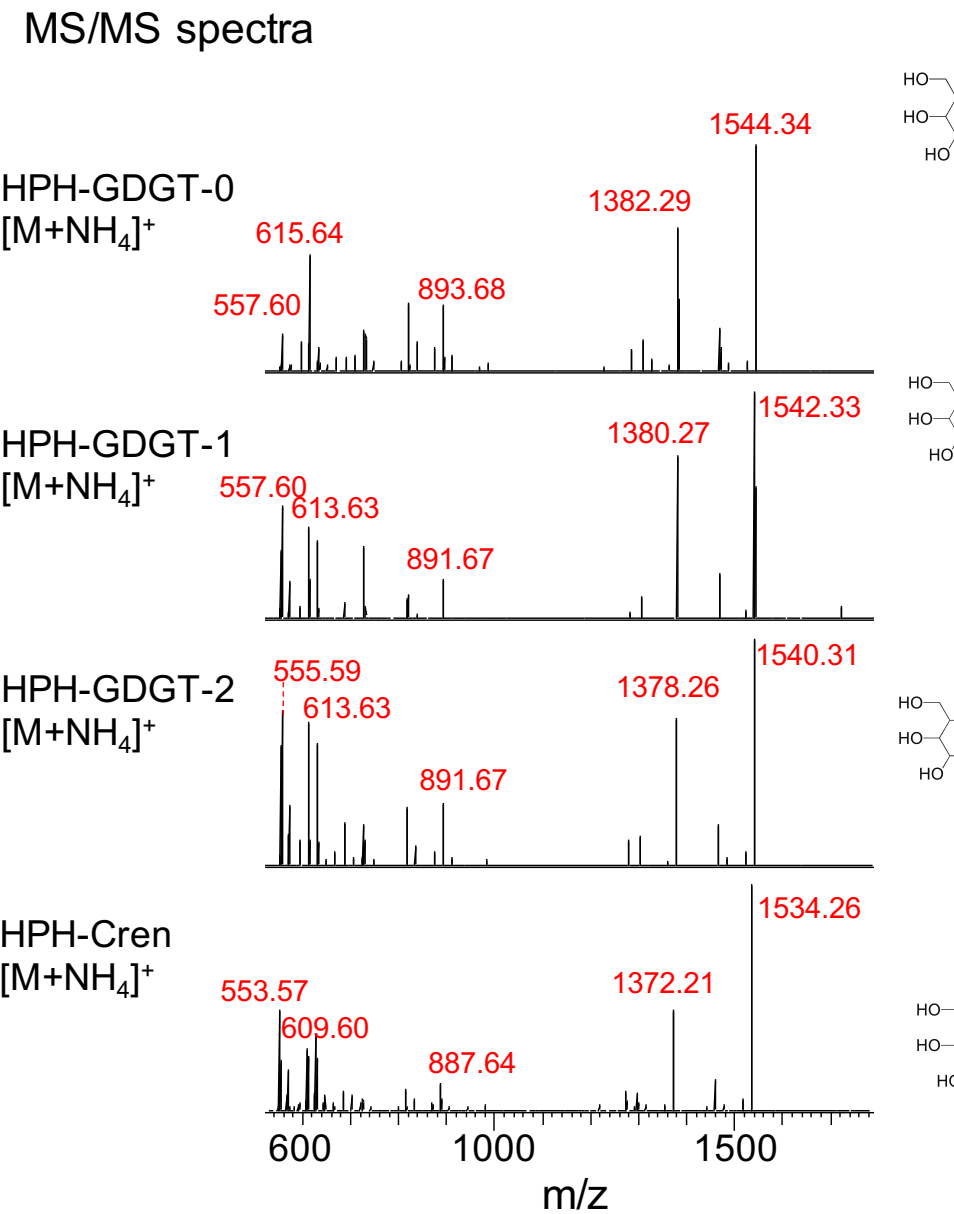
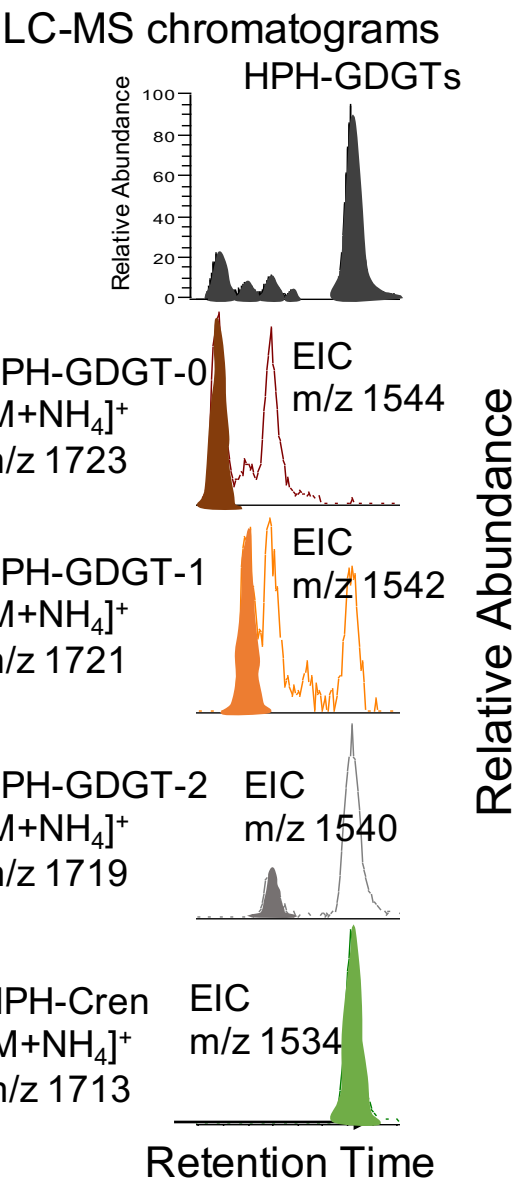


Supplementary Figure 6

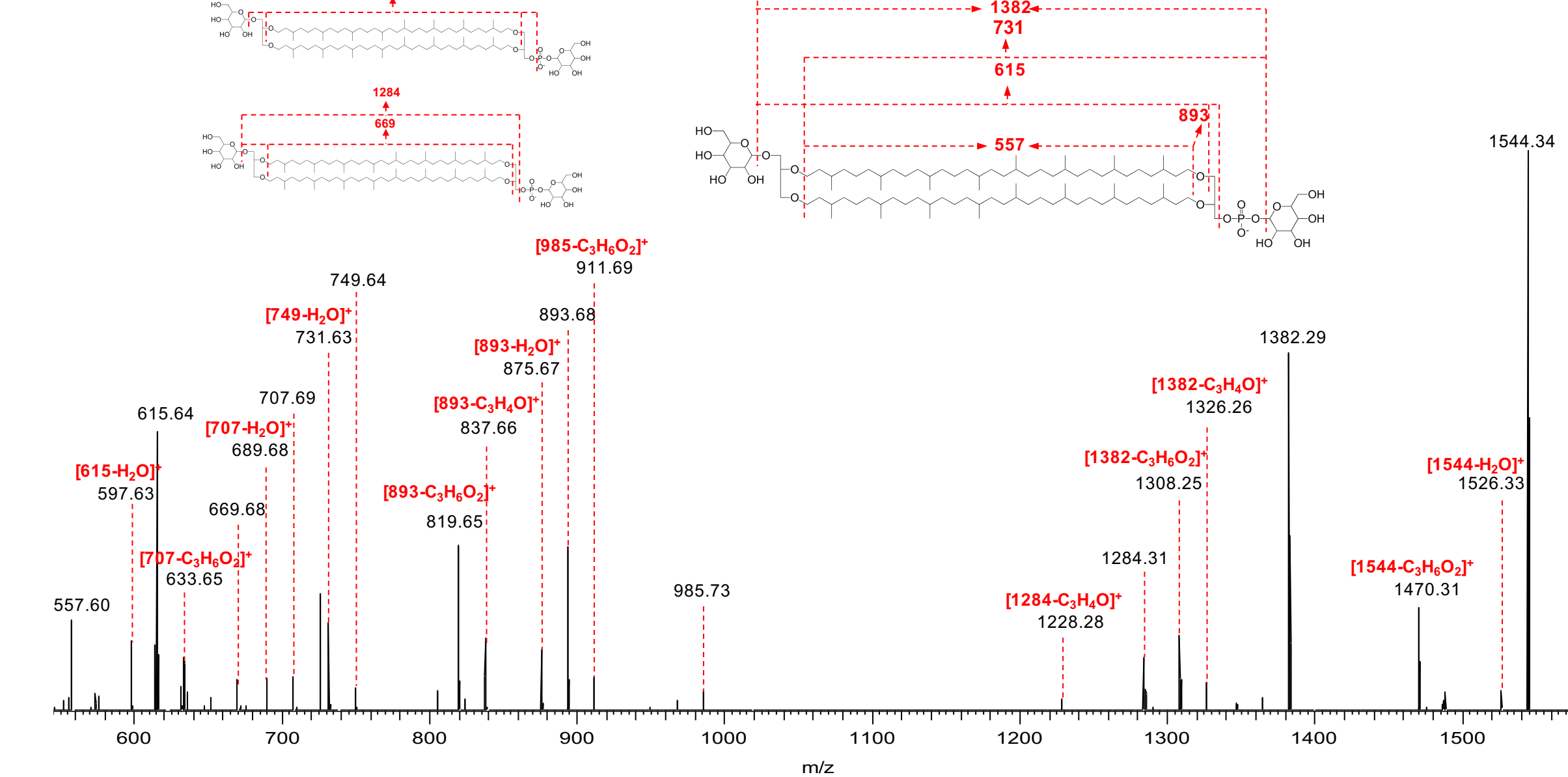
a for protonated HPH-GDGTs



b for ammoniated HPH-GDGTs

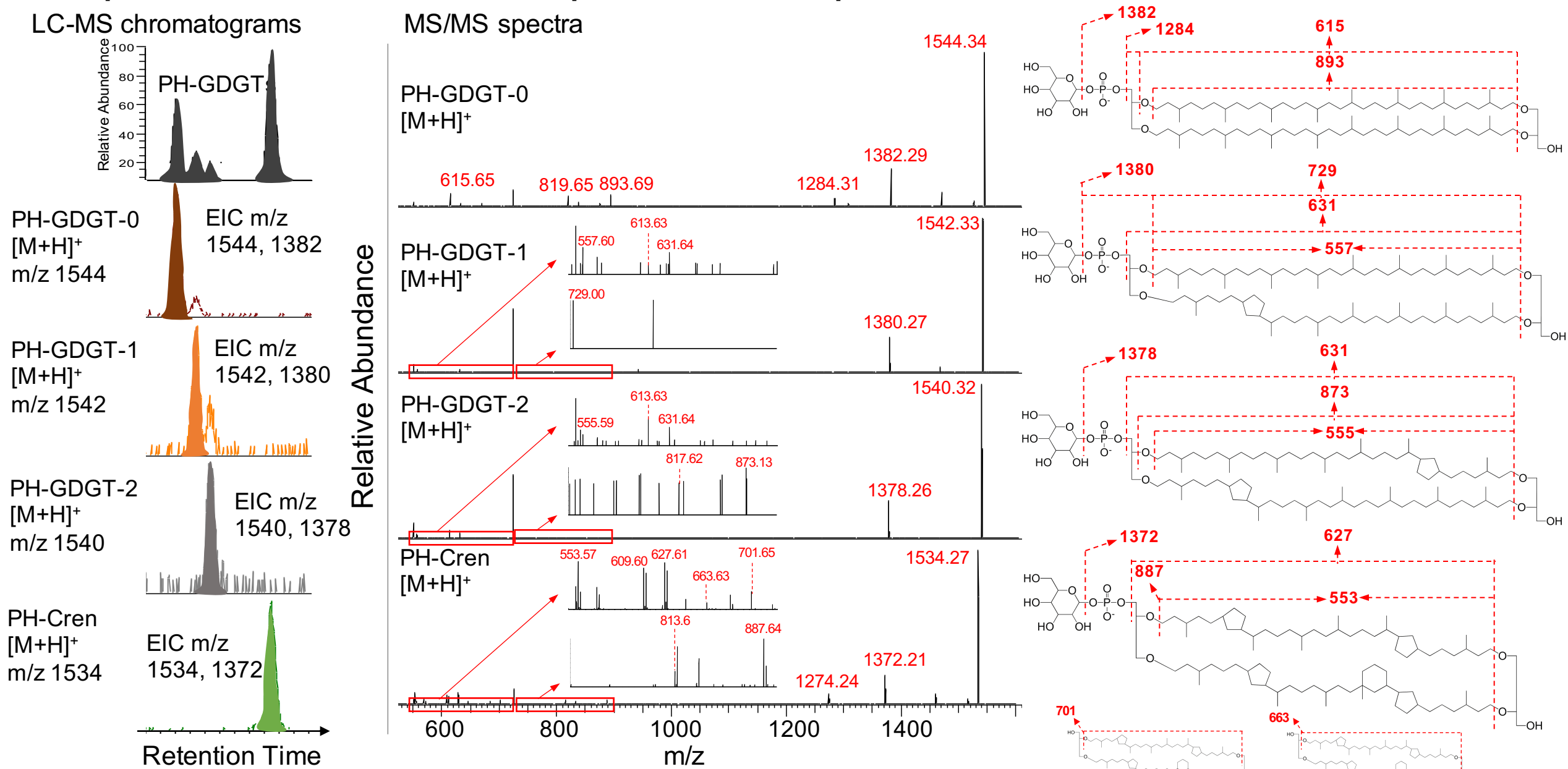


c for ammoniated HPH-GDGT-0

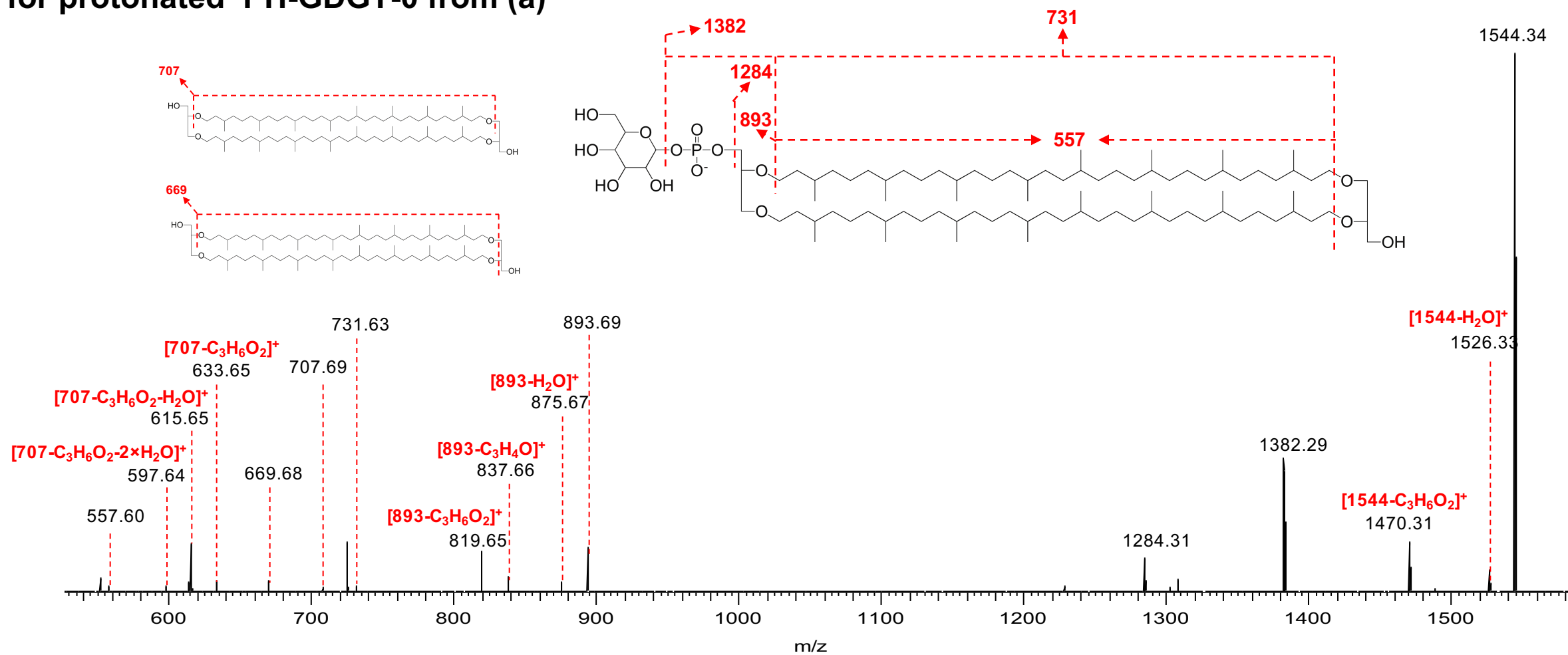


Supplementary Figure 7

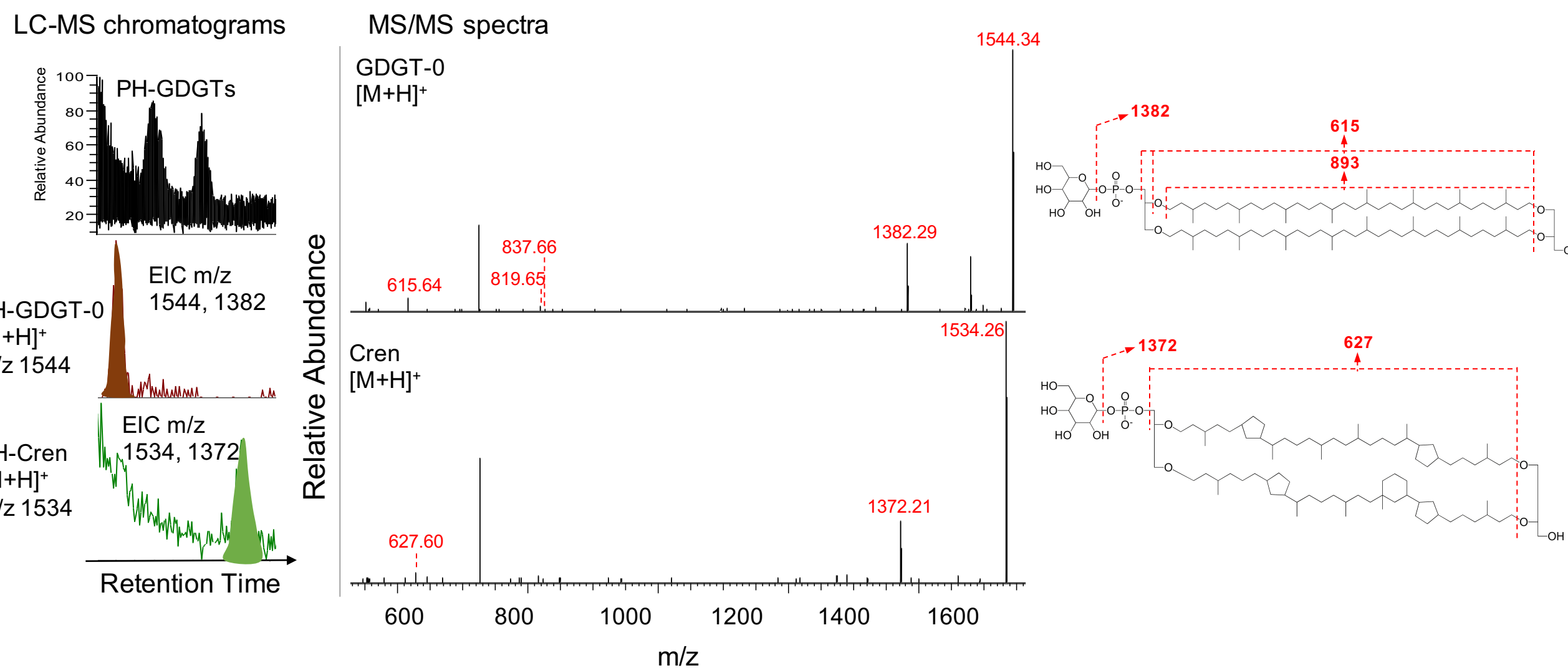
a for protonated PH-GDGTs from sample of sediment trap at 4000m of station ALOHA



b for protonated PH-GDGT-0 from (a)



c for protonated PH-GDGTs from sample at 175m of HOT296_S2

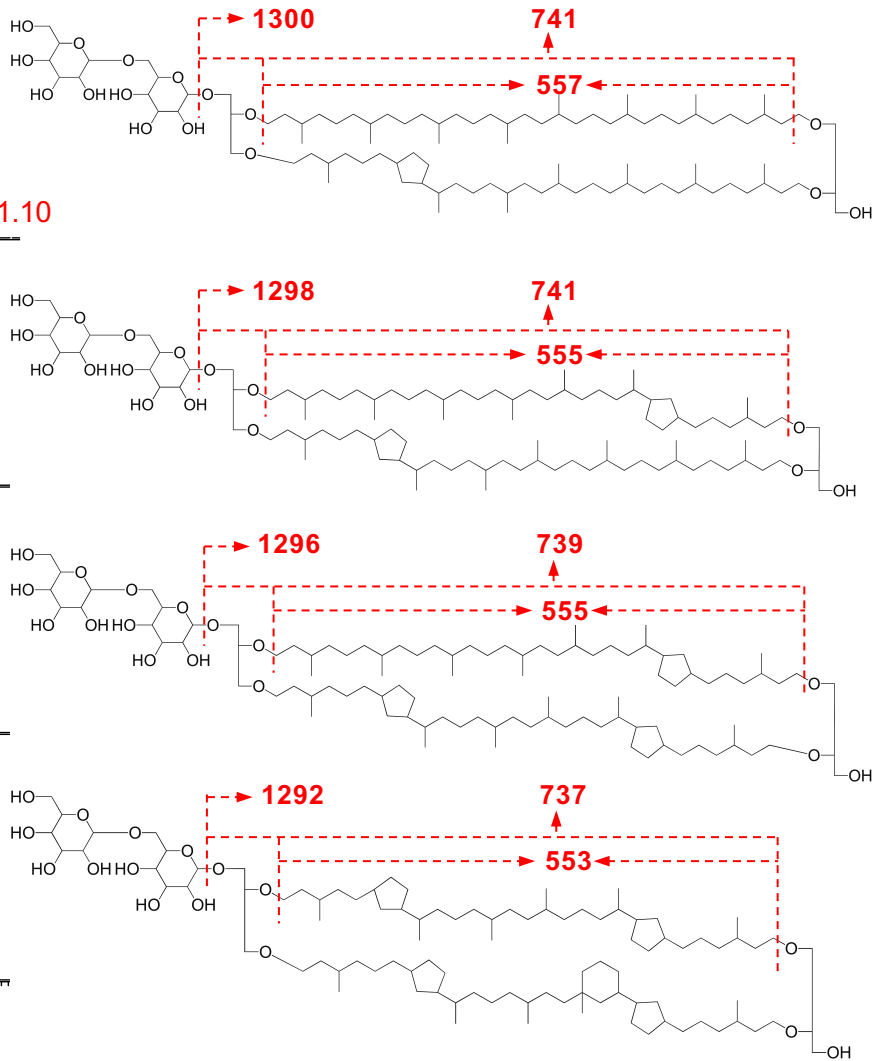
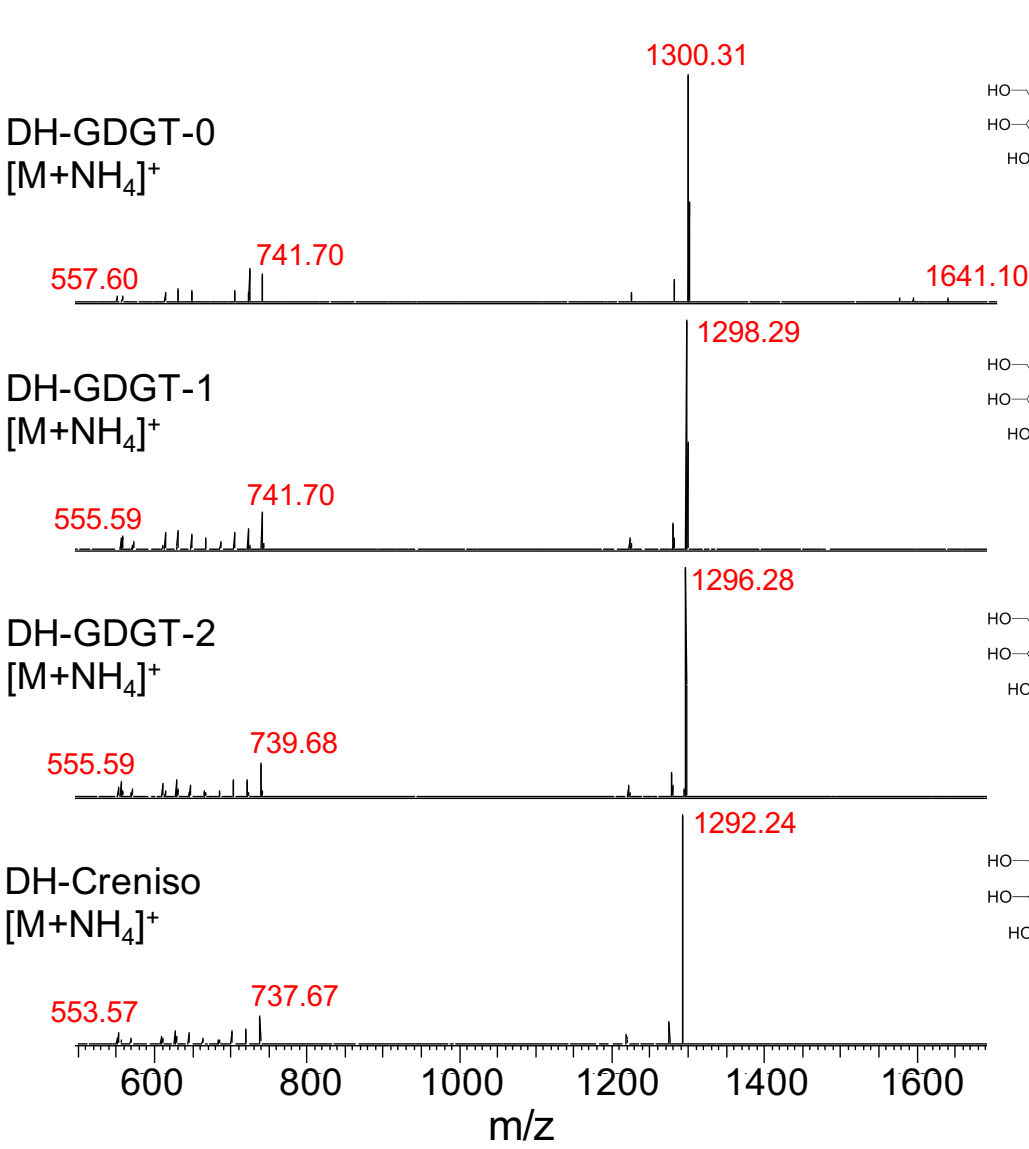
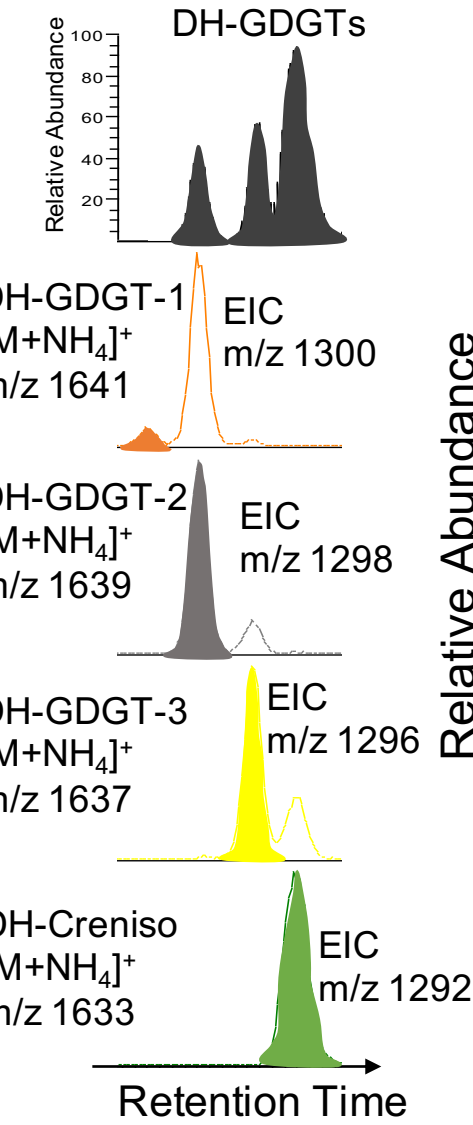


Supplementary Figure 8

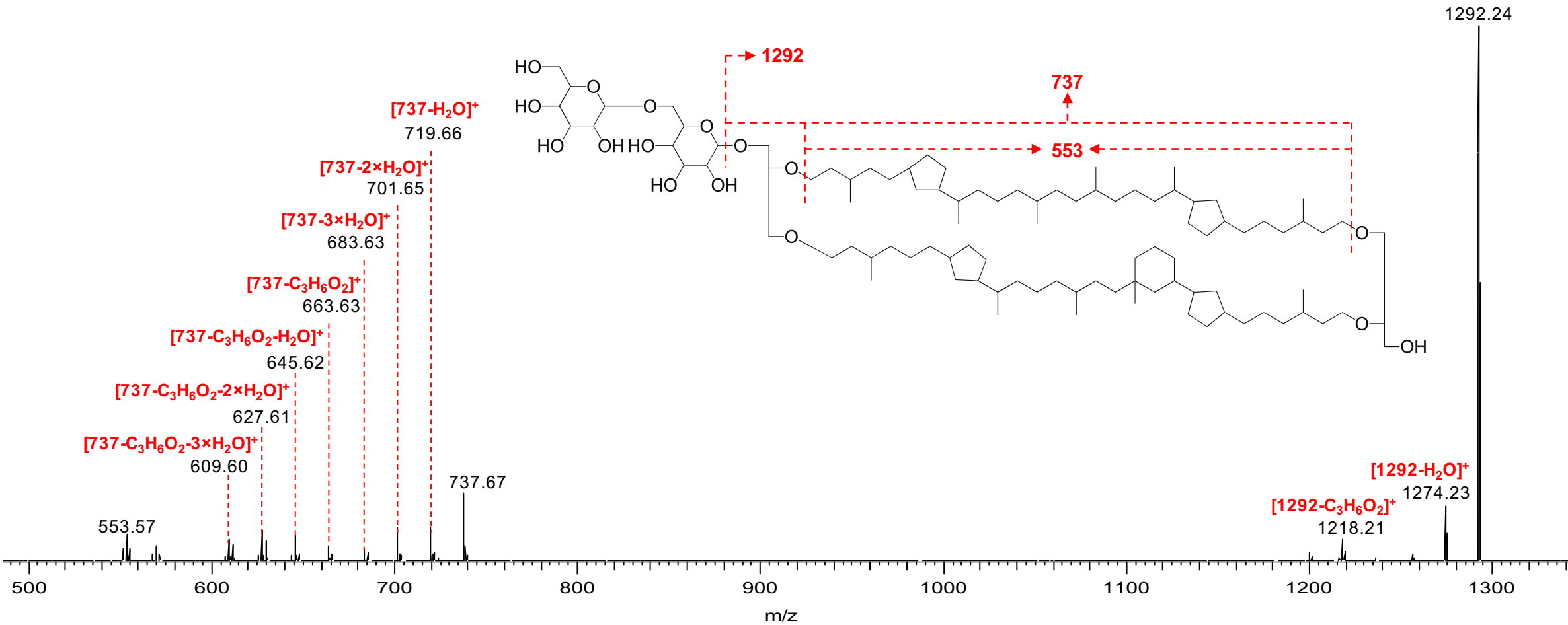
a for ammoniated DH-GDGTs

LC-MS chromatograms

MS/MS spectra



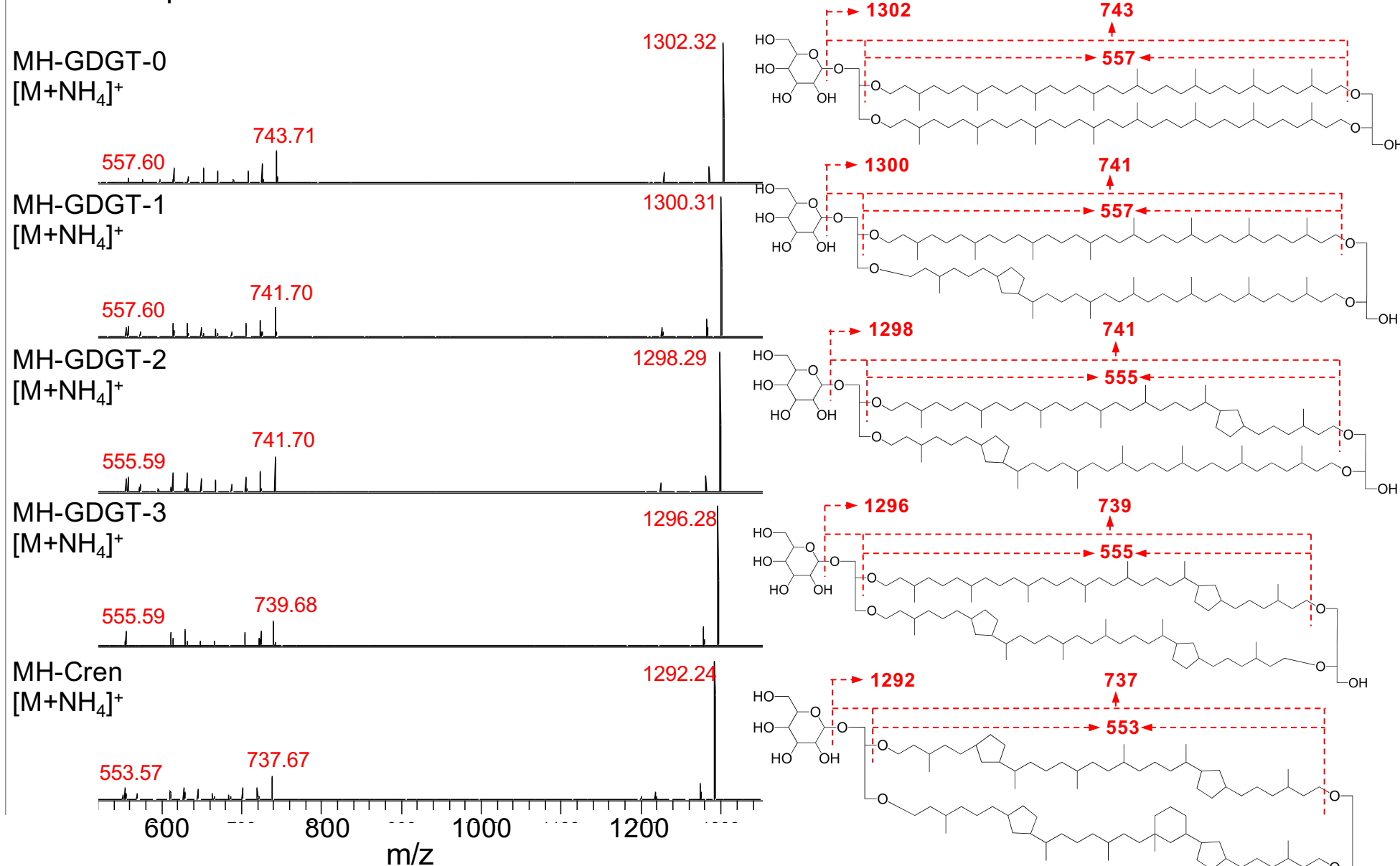
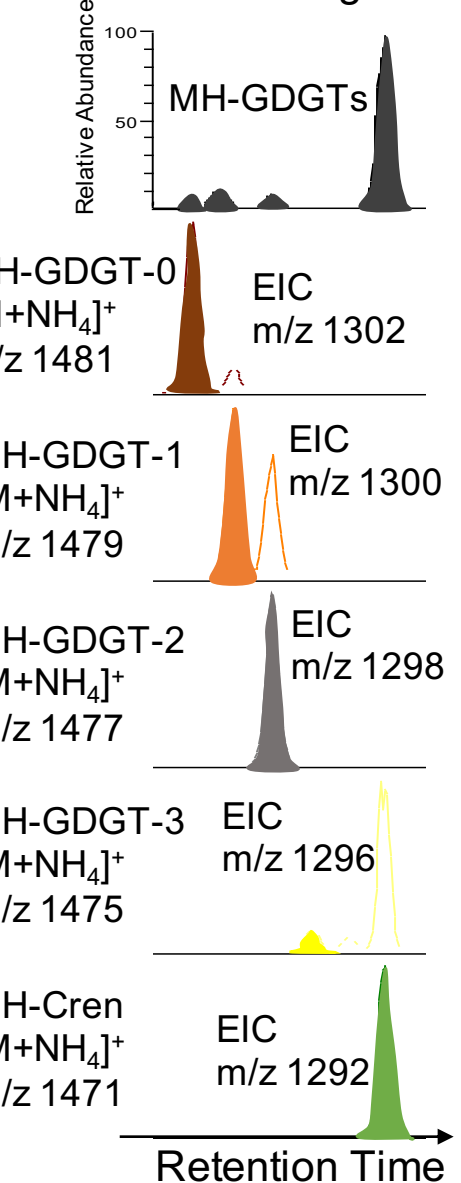
b for ammoniated DH-crenarchaeol



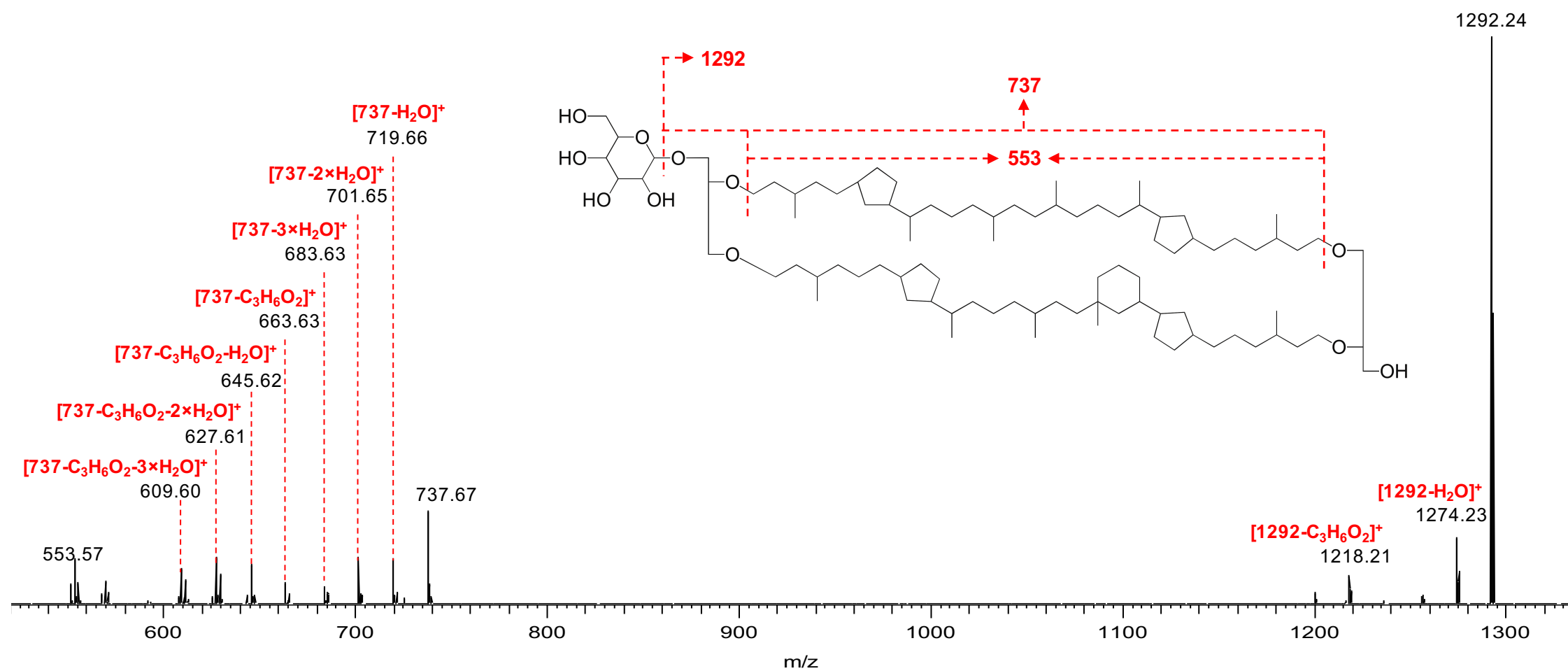
Supplementary Figure 9

LC-MS chromatograms

MS/MS spectra



b for ammoniated MH-crenarchaeol



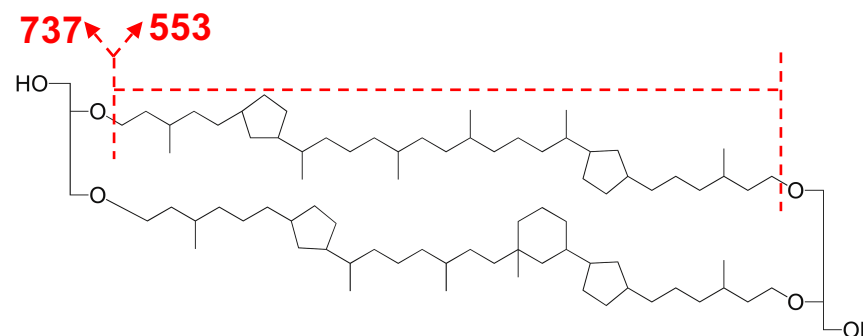
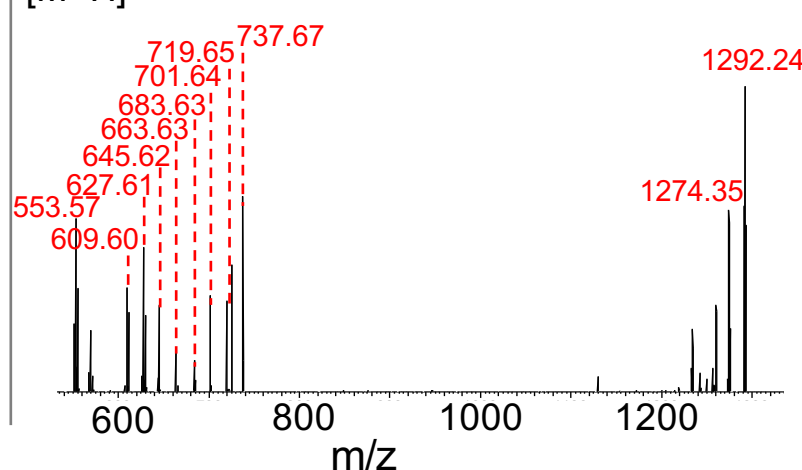
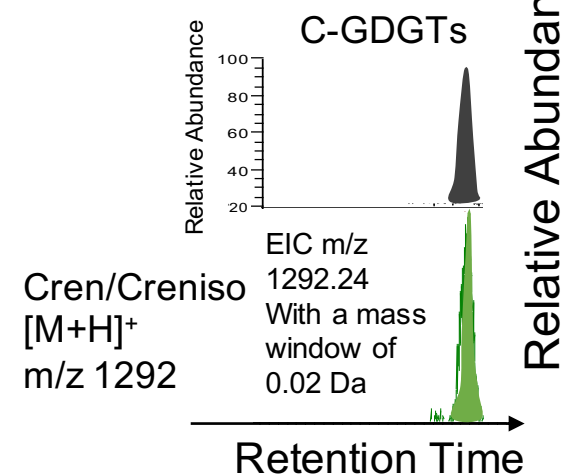
Supplementary Figure 10

a for C-GDGTs

LC-MS chromatograms

MS/MS spectra

Cren/Creniso
[M+H]⁺



b for HPH-GDGTs

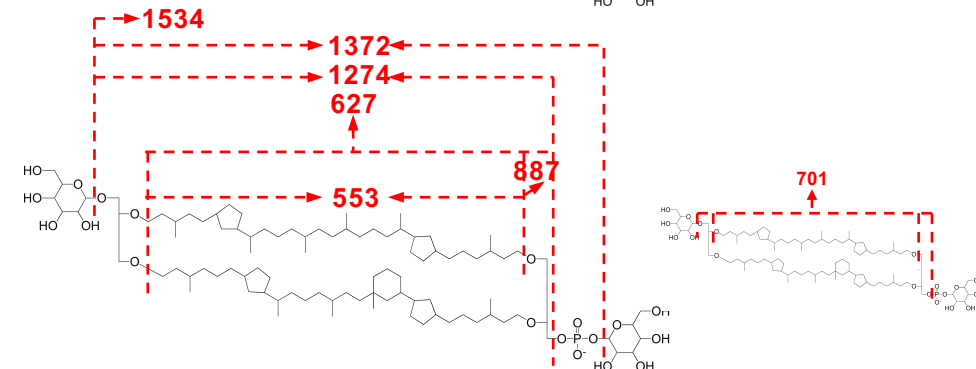
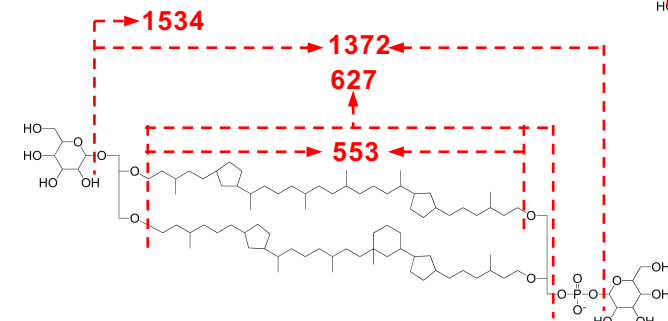
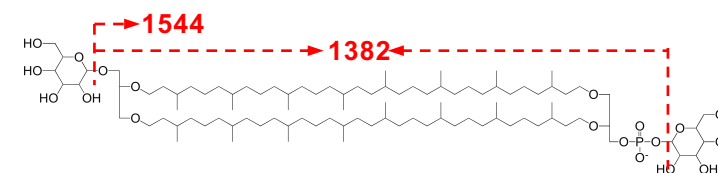
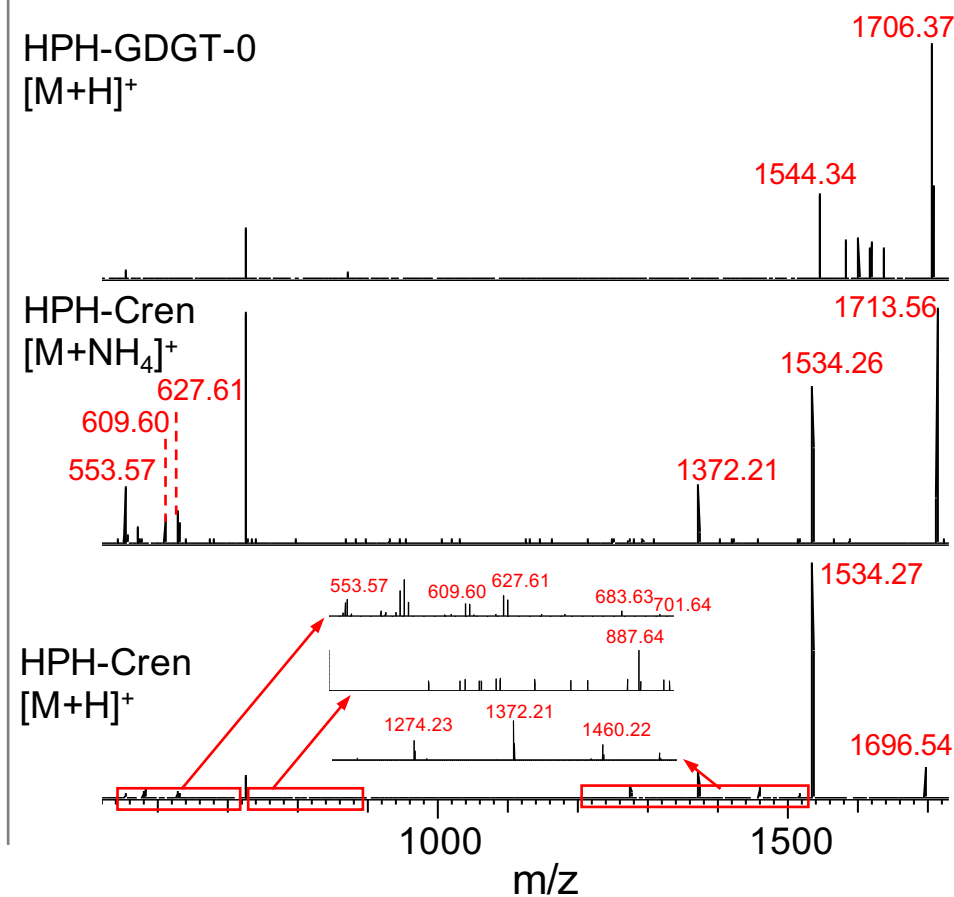
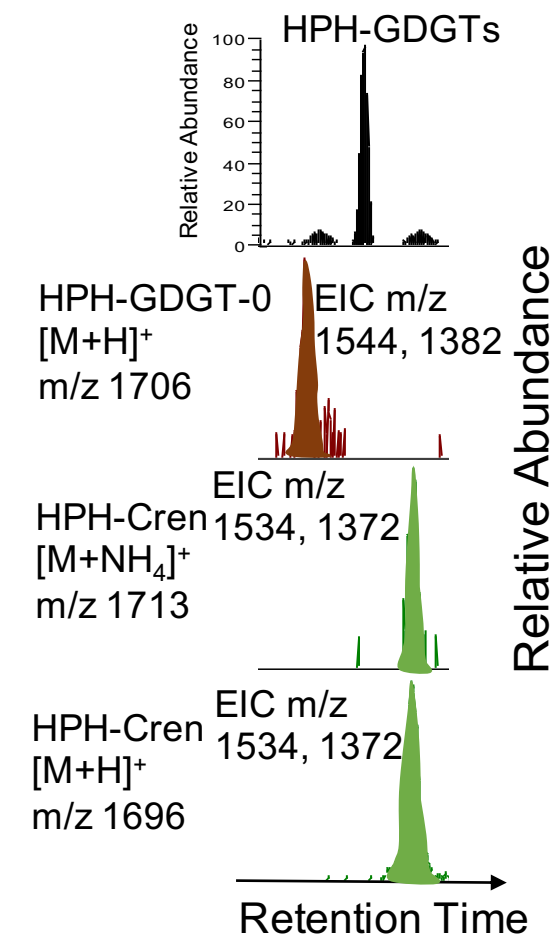
LC-MS chromatograms

MS/MS spectra

HPH-GDGT-0
[M+H]⁺

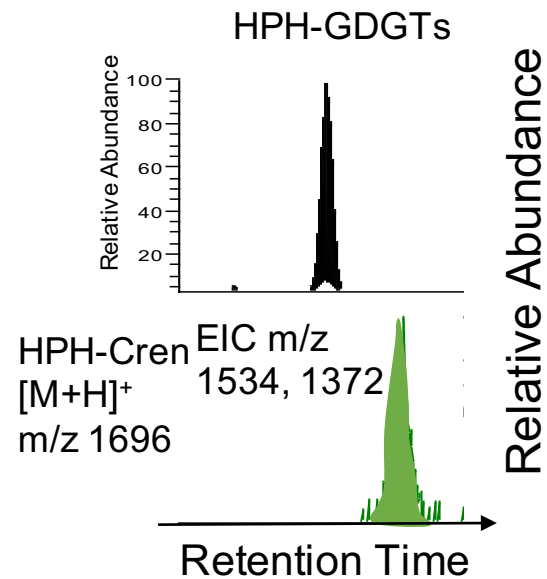
HPH-Cren
[M+NH₄]⁺

HPH-Cren
[M+H]⁺

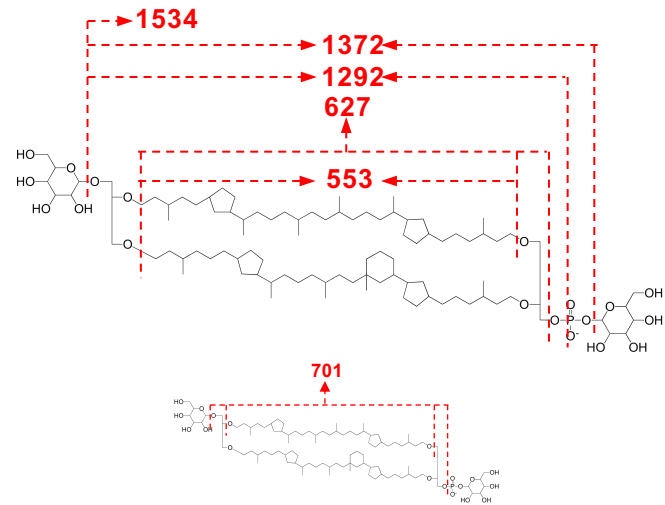
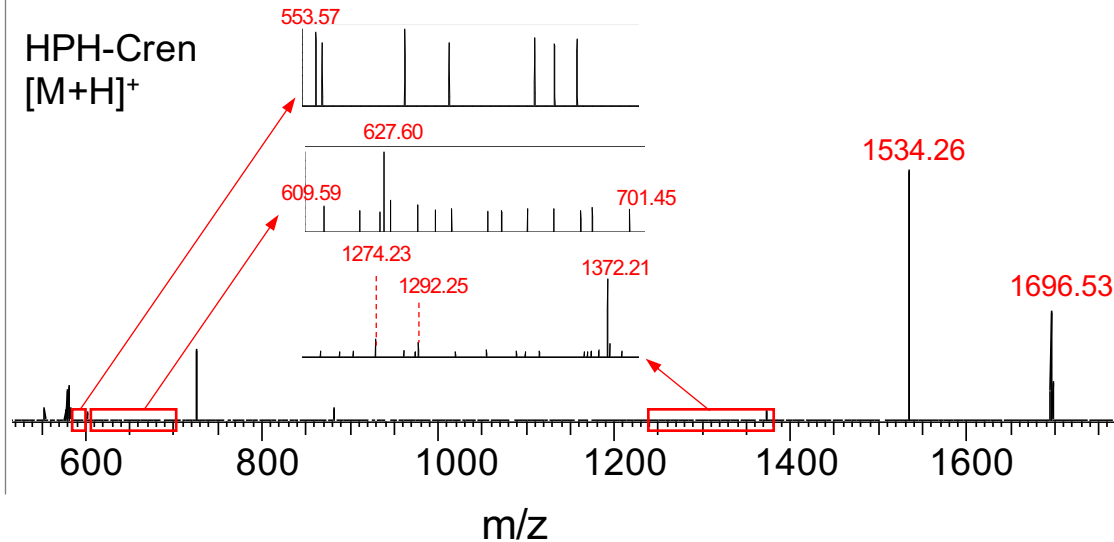


Supplementary Figure 11

LC-MS chromatograms



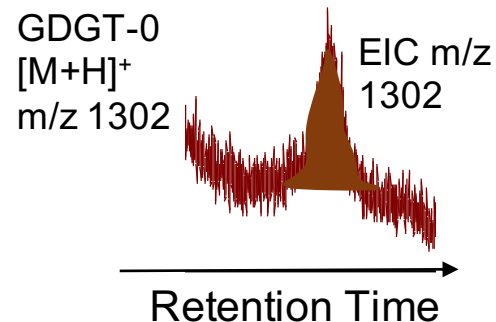
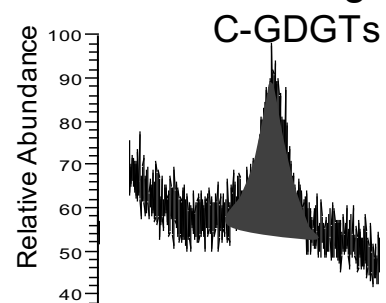
MS/MS spectra



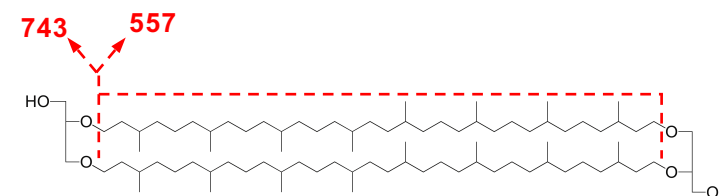
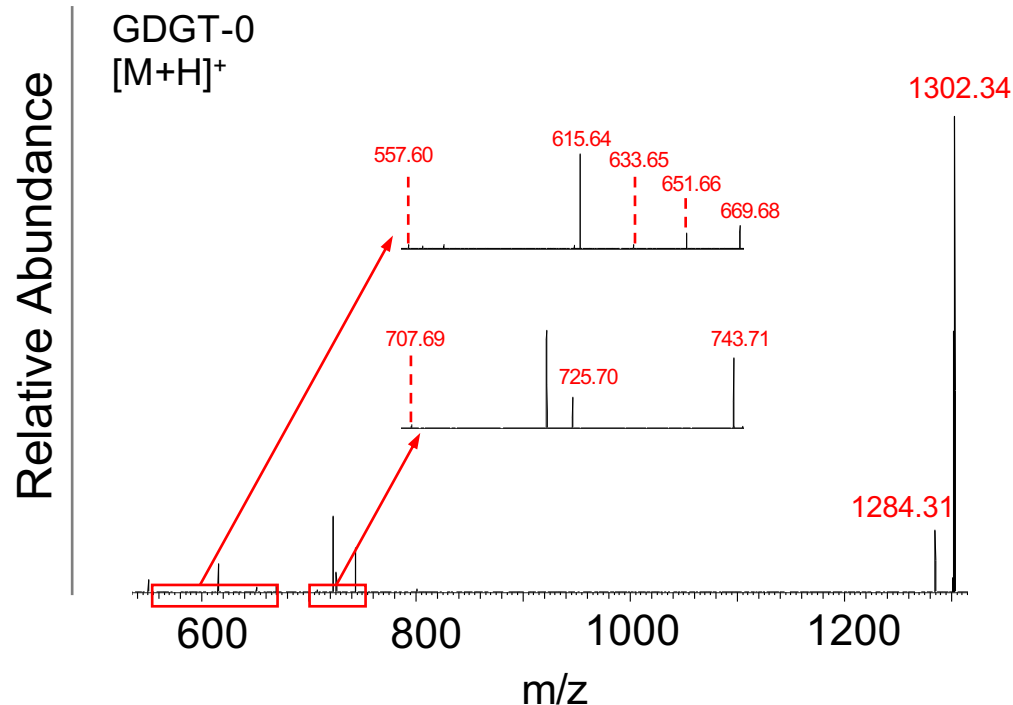
Supplementary Figure 12

a for C-GDGTs

LC-MS chromatograms

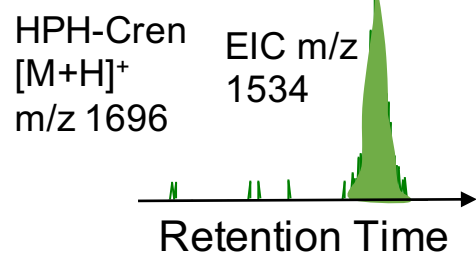
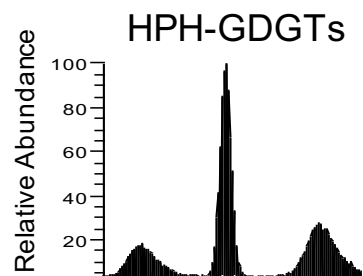


MS/MS spectra

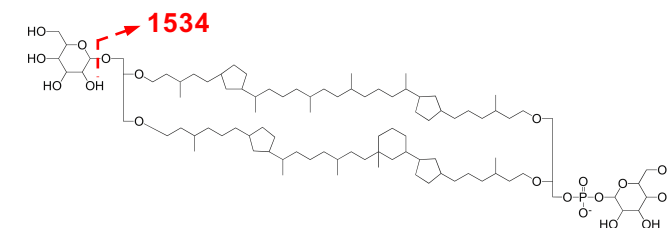
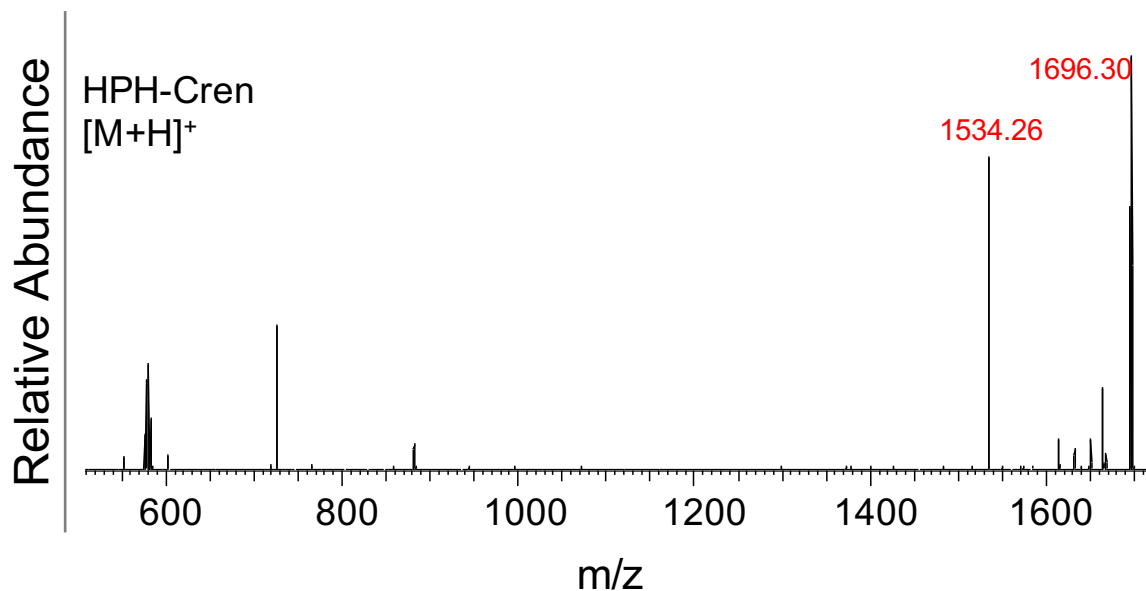


b for HPH-GDGTs

LC-MS chromatograms



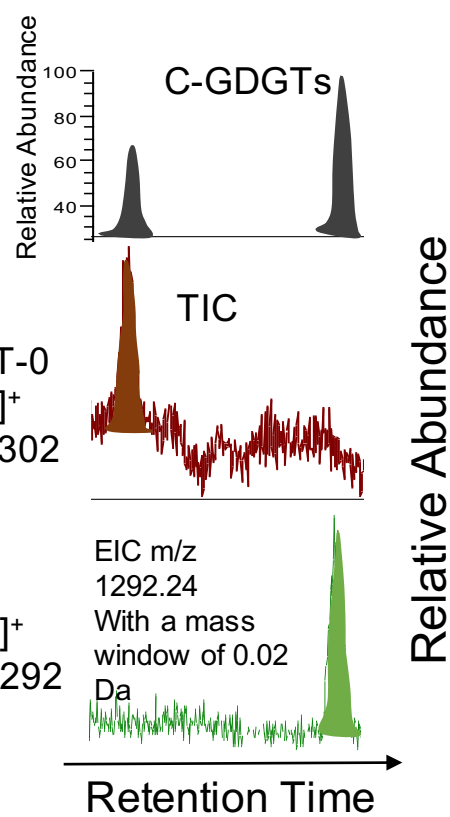
MS/MS spectra



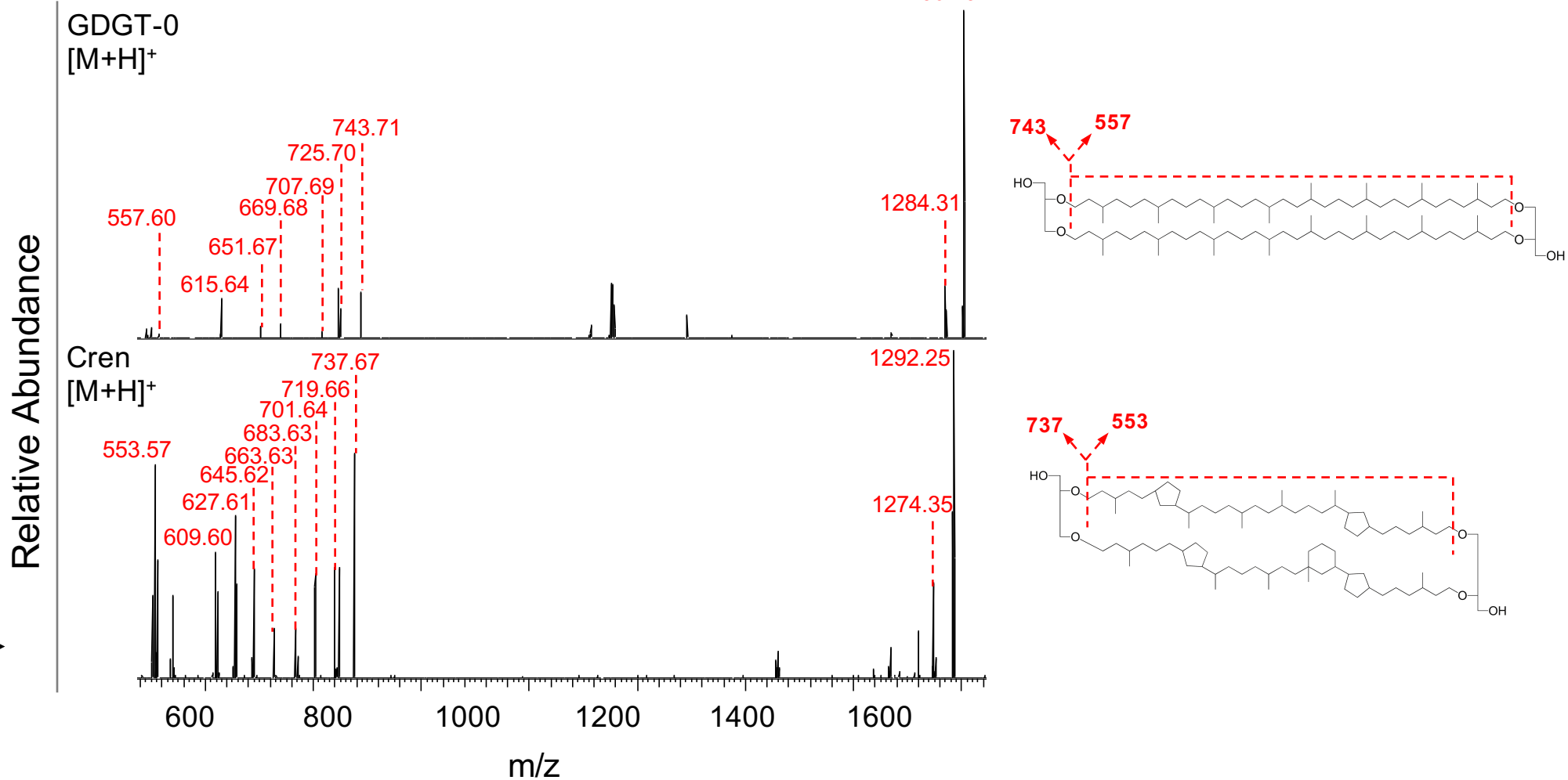
Supplementary Figure 13

a for C-GDGTs

LC-MS chromatograms

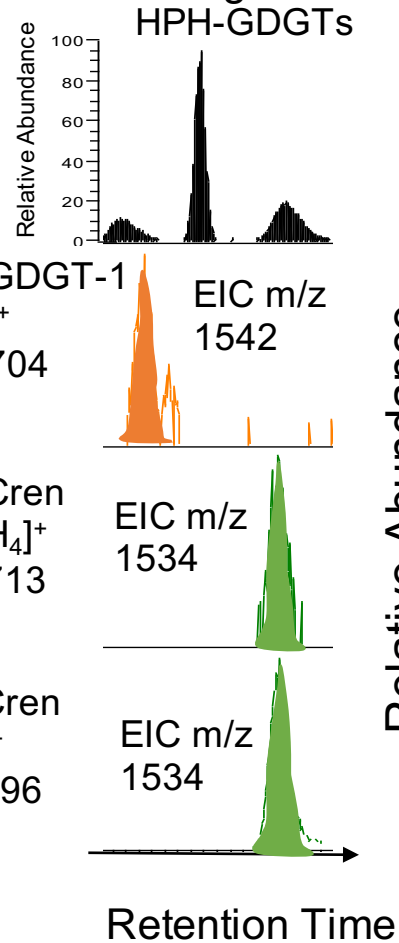


MS/MS spectra

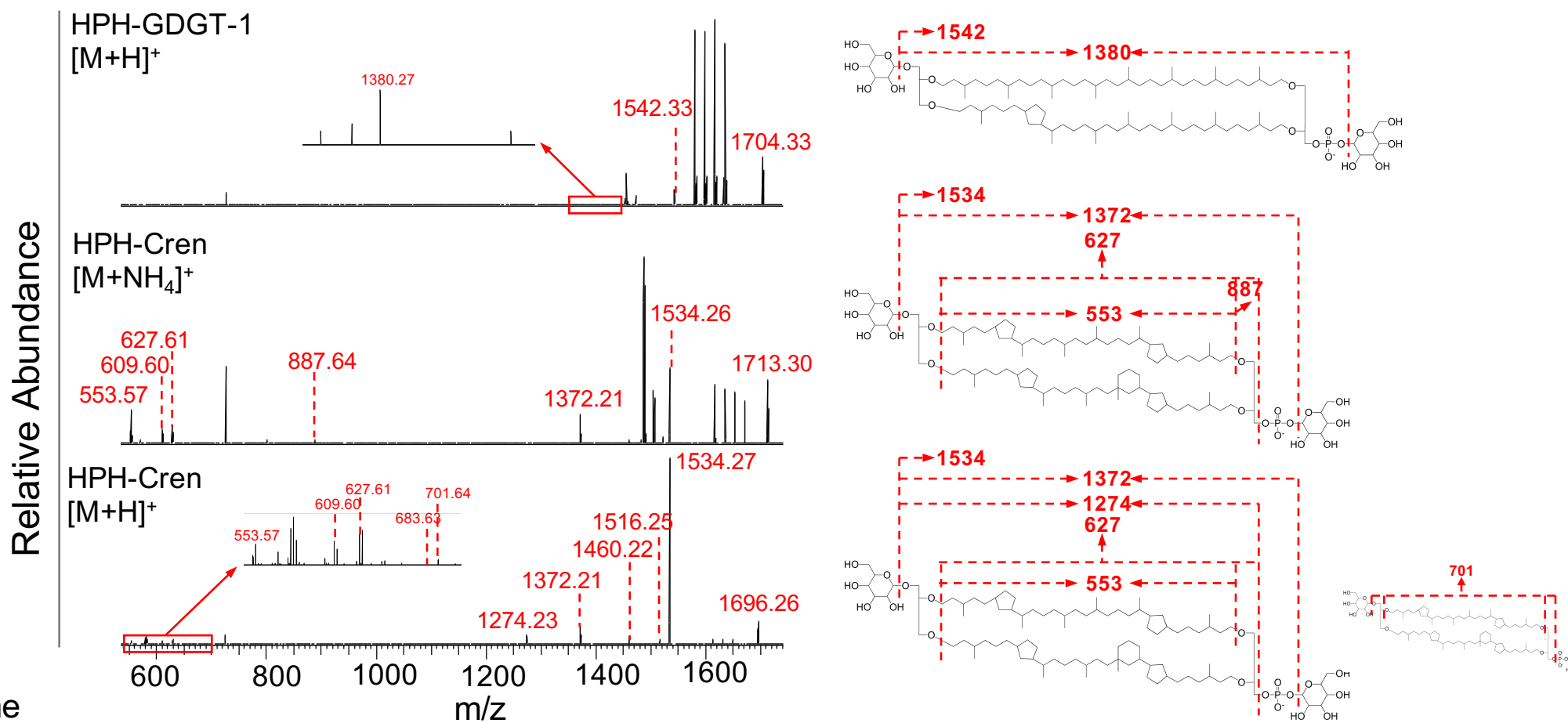


b for HPH-GDGTs

LC-MS chromatograms

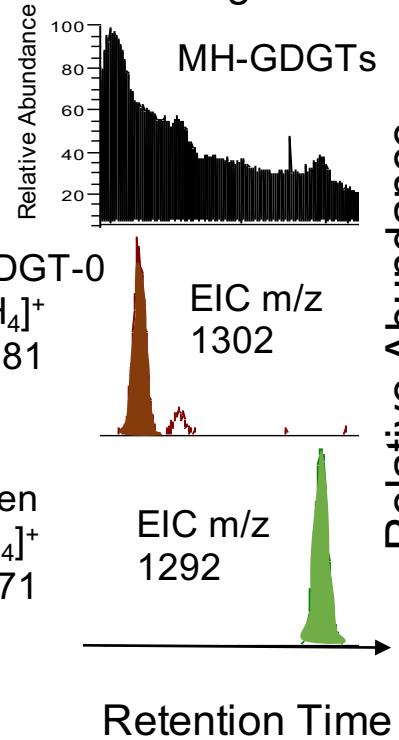


MS/MS spectra

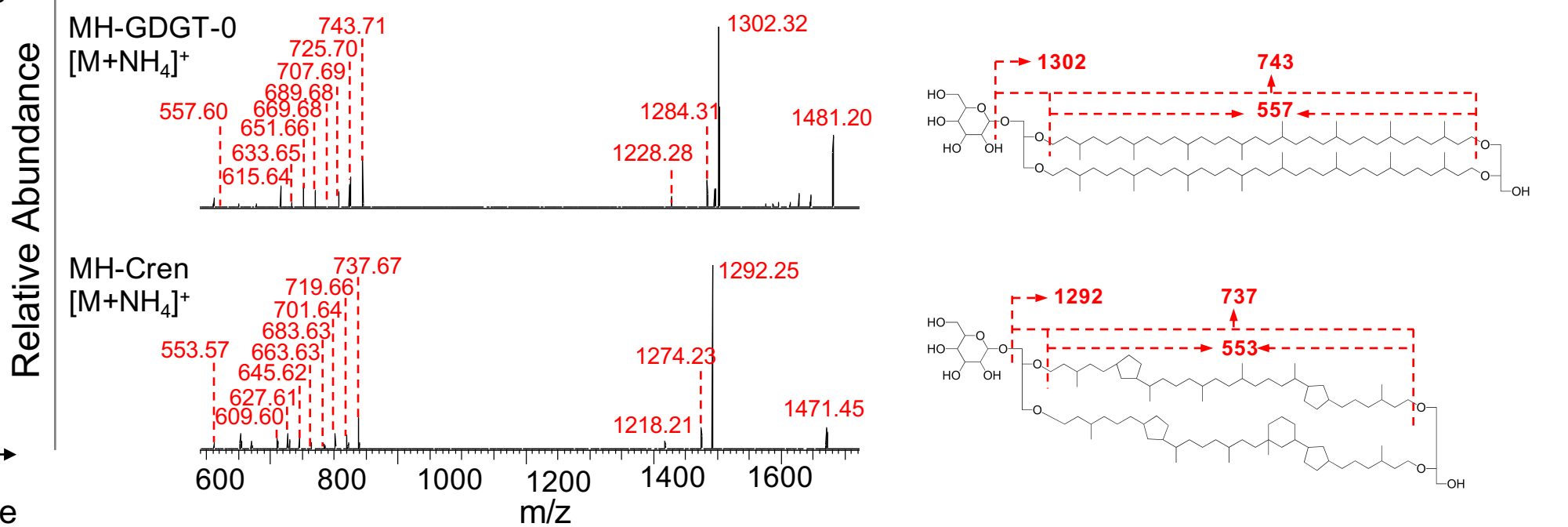


c for MH-GDGTs

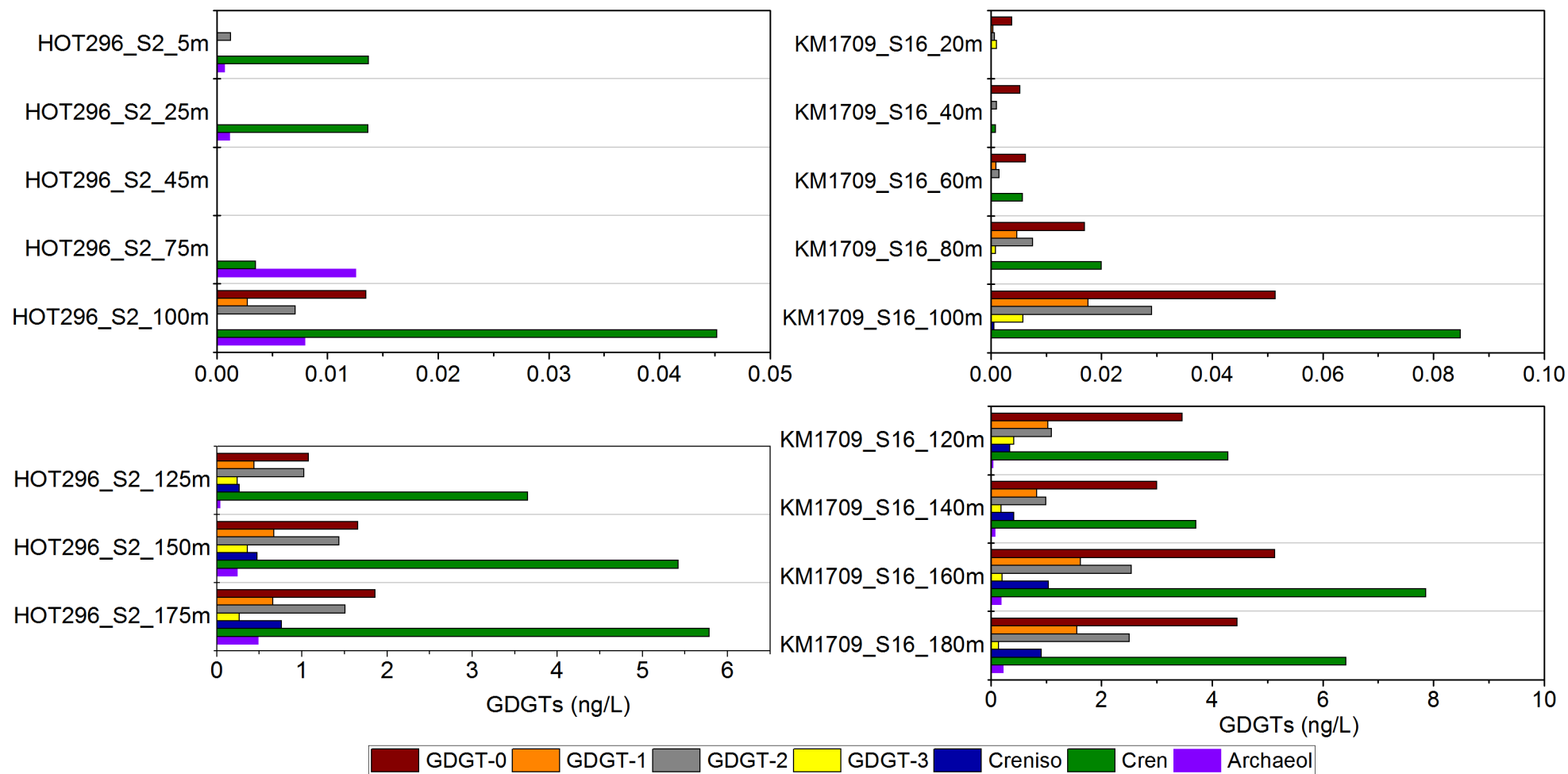
LC-MS chromatograms



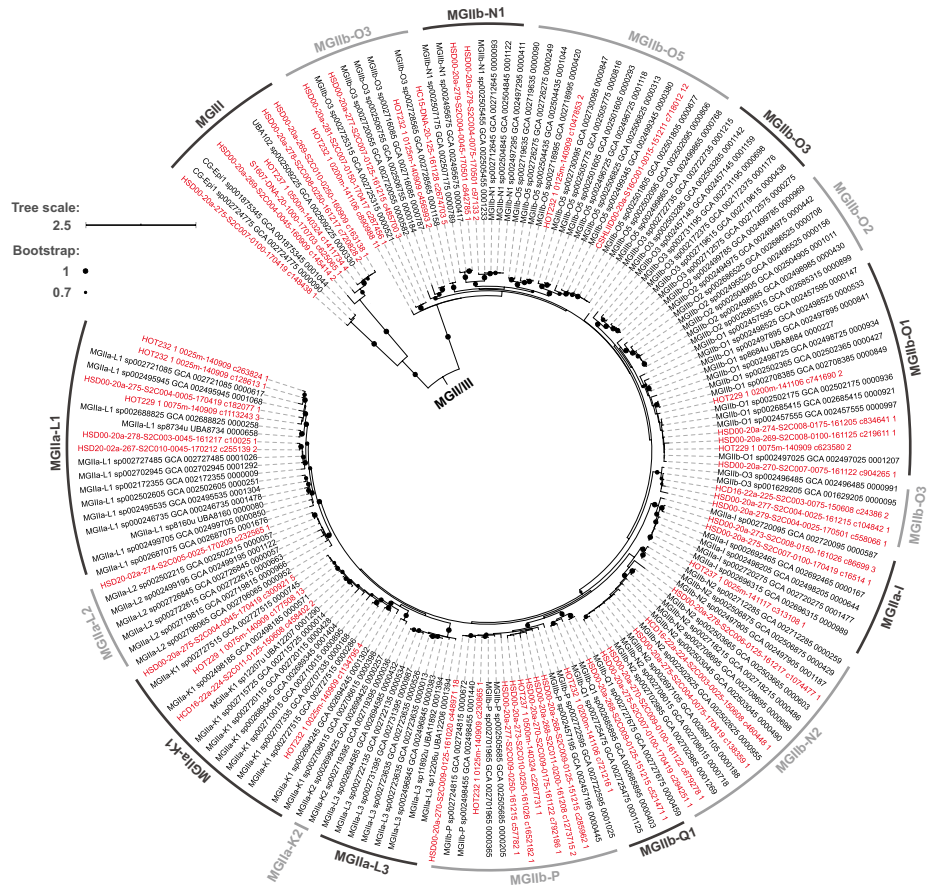
MS/MS spectra



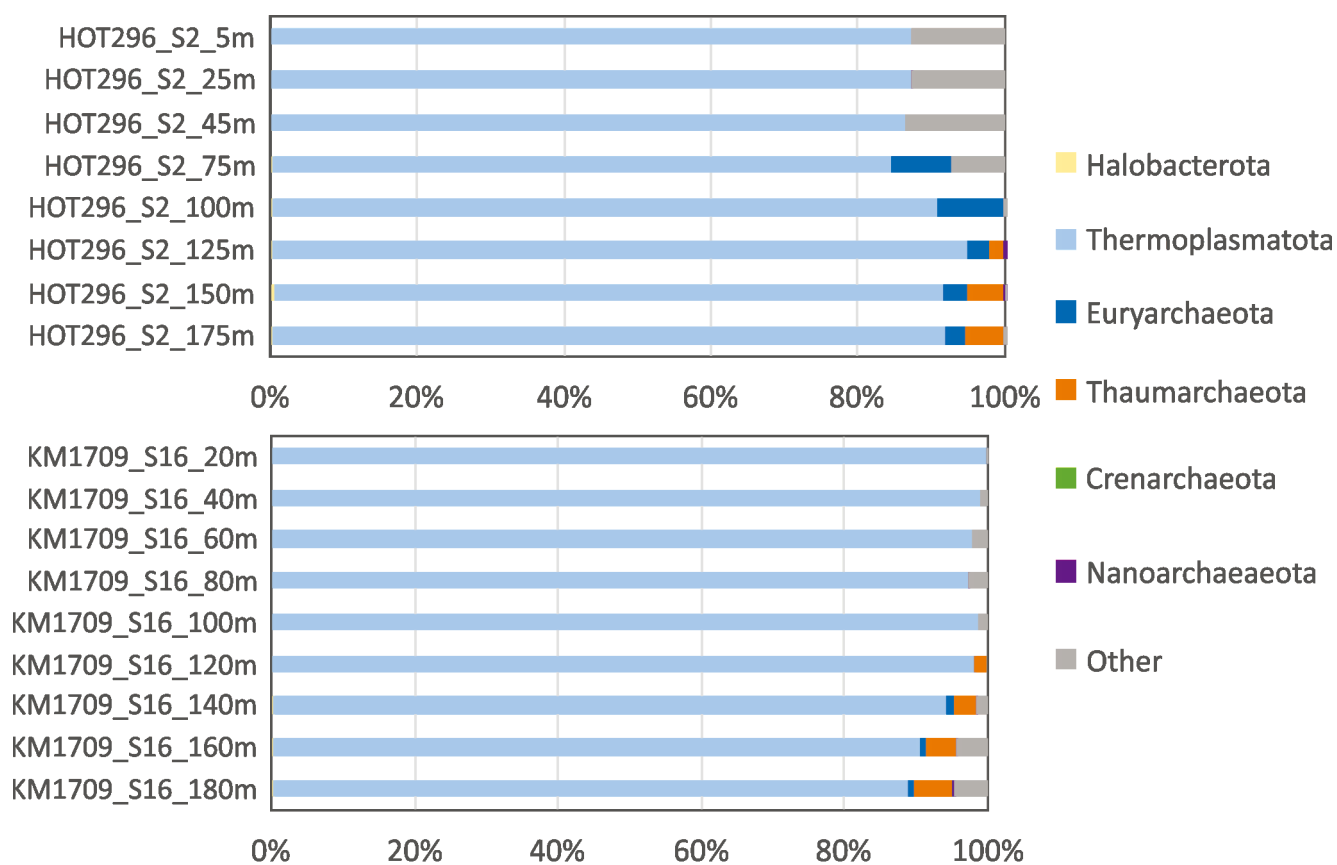
Supplementary Figure 14



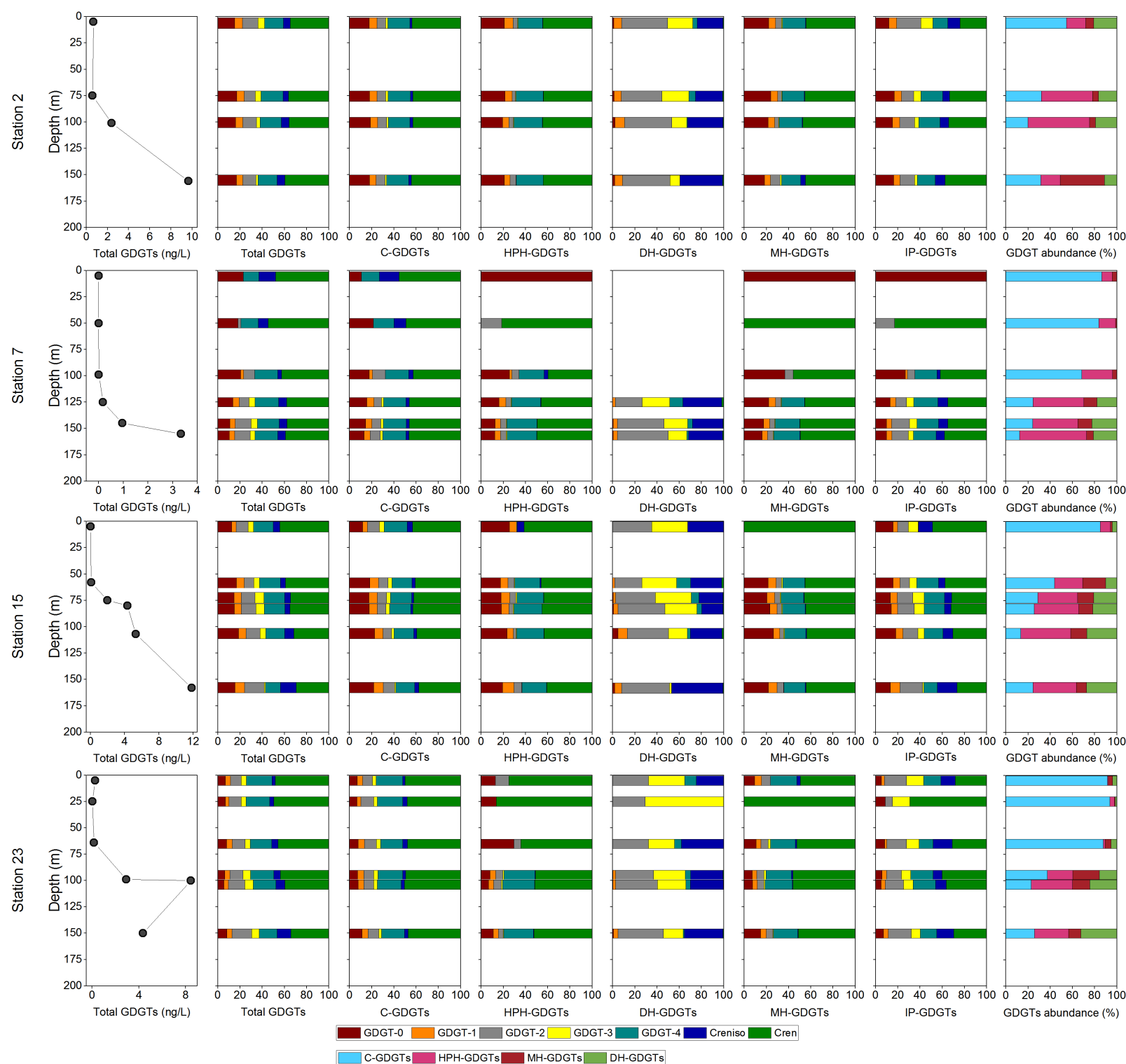
Supplementary Figure 15



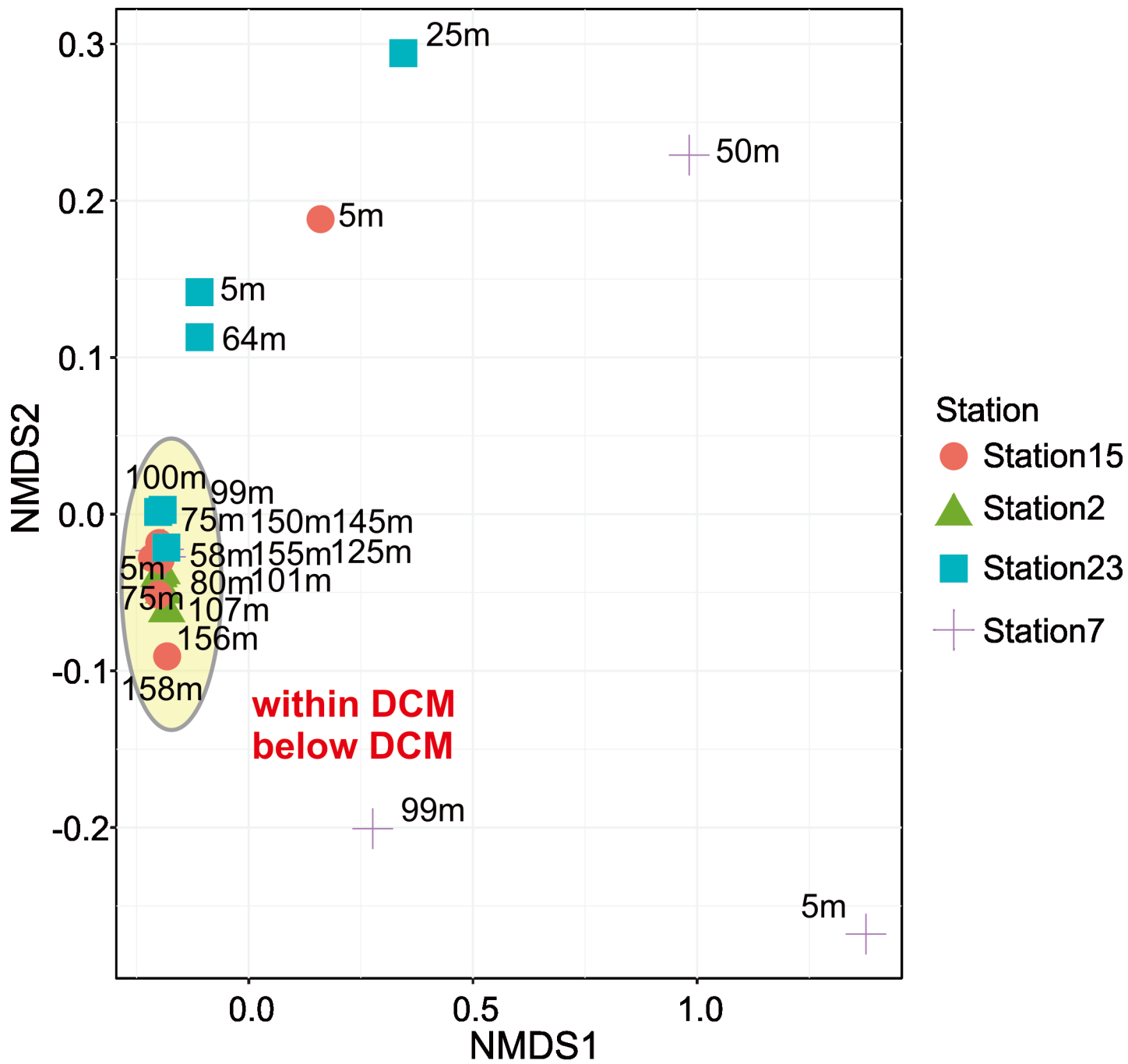
Supplementary Figure 16



The relative abundance of Archaea
Supplementary Figure 17



Supplementary Figure 18



Supplementary Figure 19