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Evolution of Seaward Dipping Reflections at the onset of oceanic crust formation.

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Supplementary information

Here we provide supplementary information to support the analysis presented.

Figure S1

We apply standard interpretation techniques on the controlled seismic reflection profile. This involves identification of reflection terminations, including erosional truncation, downlap, onlap and is based upon the geometry character of the profile into post-rift, syn-rift and pre-rift. We also use seismic facies identification (coherent, non-coherent, anastomosing, chaotic) to define crustal type as identified on Figure S1. We also recognise areas of low amplitude/transparent character and high amplitude, discontinuous character. As outlined in the text we associate these with oceanic crustal architecture. The interpretation was undertaken using the initial profile in its present day position. The high amplitude and continuous reflection at a variable depth of 30 km to 7 km is interpreted as being the Moho.

Figure S2

We take the interpreted profile in Figure S1 and flattened it such that the reflection corresponding to the break-up unconformity is restored to a datum close to the horizontal in order to reflect the geometry at the time of the final SDR emplacement. Through that restoration we passively carry our interpretation to maintain the geometry.

Figure S3

Here we focus on the evolution of three well imaged SDR packages (t=1, 2 and 3), as identified in figure (a). In the final model (Figure 3) we use a topography derived from the digital elevation model of Afar (Figure S4) to be a realistic datum rather than a true horizontal. In figure (b) for each time event we restore the relevant horizon to the datum and then remove the section to the east of the horizon as that was new crust generated in the subsequent time event. At this stage each section is restored using a pin line on the left (west) of the profile. In figure (c) we superimpose the restored interpretation onto the topography highlighted in Figure S4. In figure (d) we predict the geometry of the conjugate by assuming a symmetrical spreading axis in the centre, as indicated by the pin line. In these images we have shown the SDRs at a higher resolution to show the level of geometrical detail that we have considered. In the final model (Figure 3) we superimpose this high resolution onto the crustal image (Figure S3) to enable us to constrain the Moho location, position of the sheeted dikes, lower intrusions, and transition into continental crust.

Figure S4

For our restoration we use the topography of the Danakil Depression as a datum. This map shows the location of a) Afar and b) Danakil Depression with the location of the topography used in the model in the highlighted white box.

Figure S1

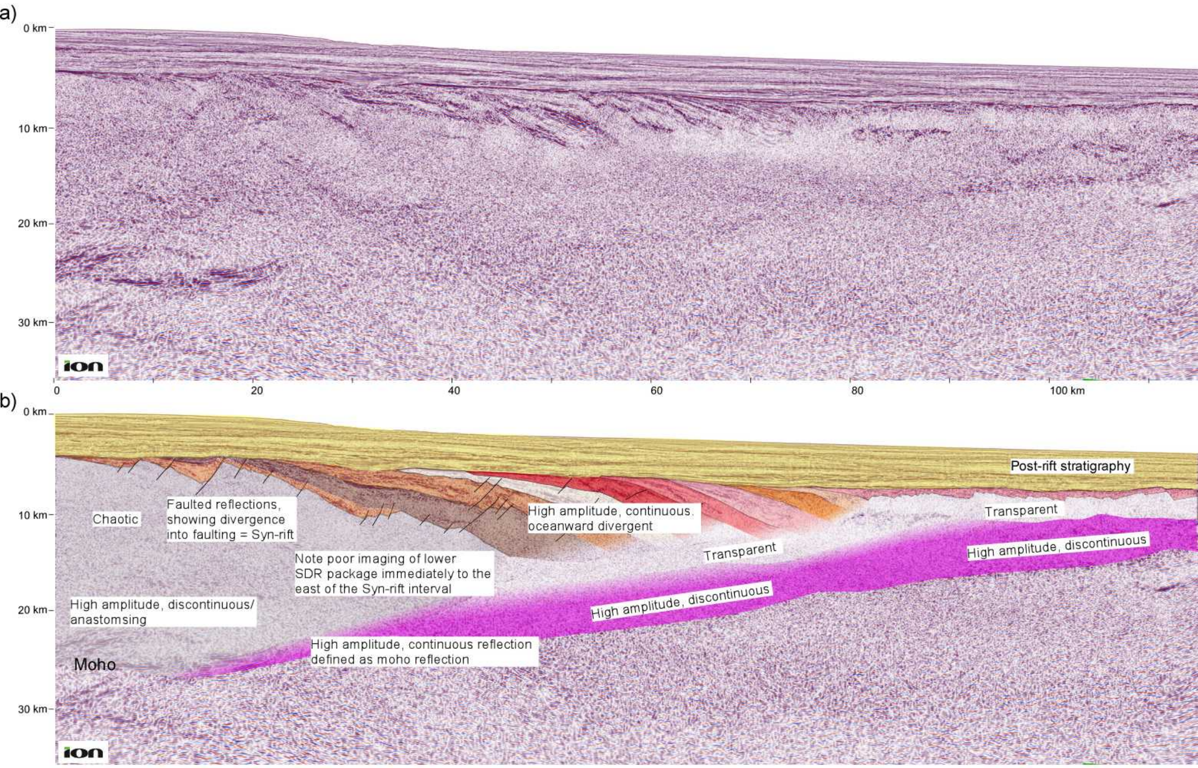


Figure S2

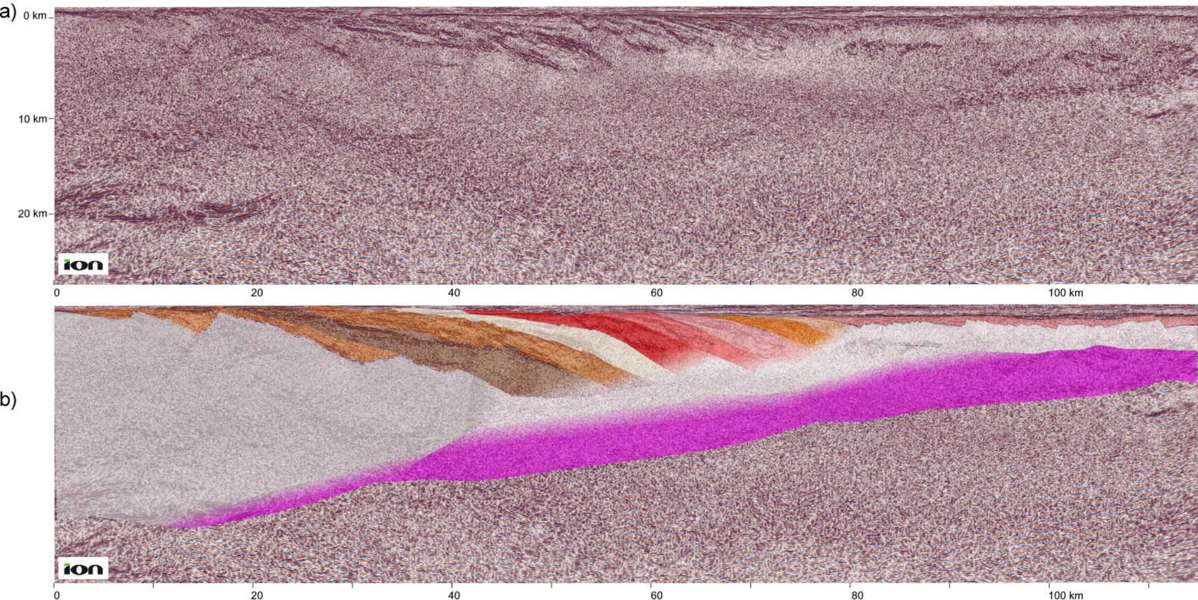
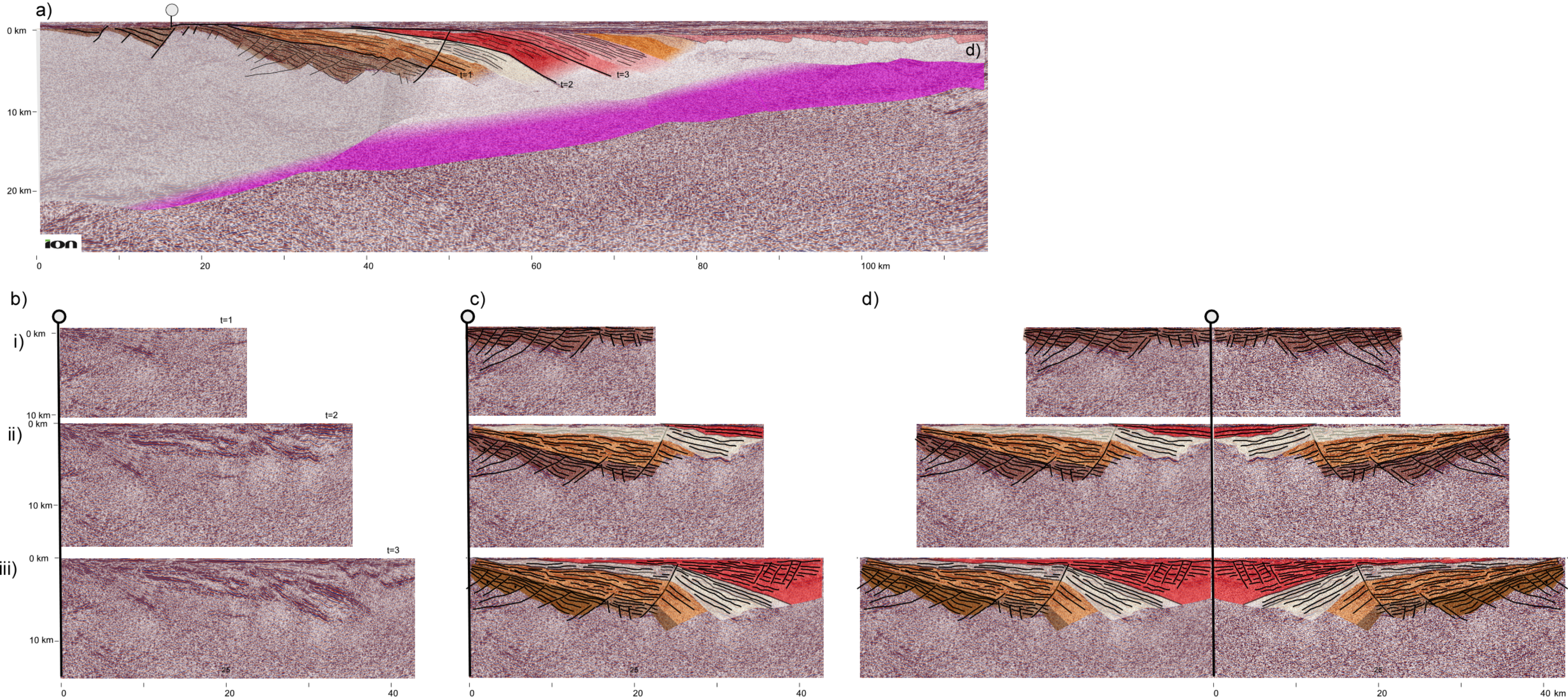


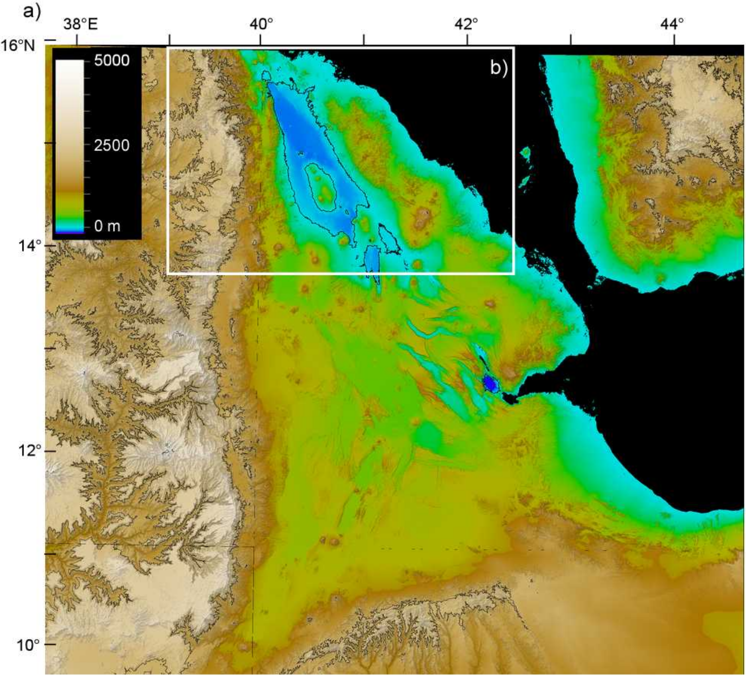
Figure S3



a)
0 km
10 km
20 km
t=1
t=2
t=3
d)
ion
0
20
40
60
80
100 km
b)
c)
d)
i)
ii)
iii)
t=1
t=2
t=3
0 km
10 km
0 km
10 km
0 km
10 km
0
20
40
0
20
40
0
20
40 km

Figure S4

a)



b)