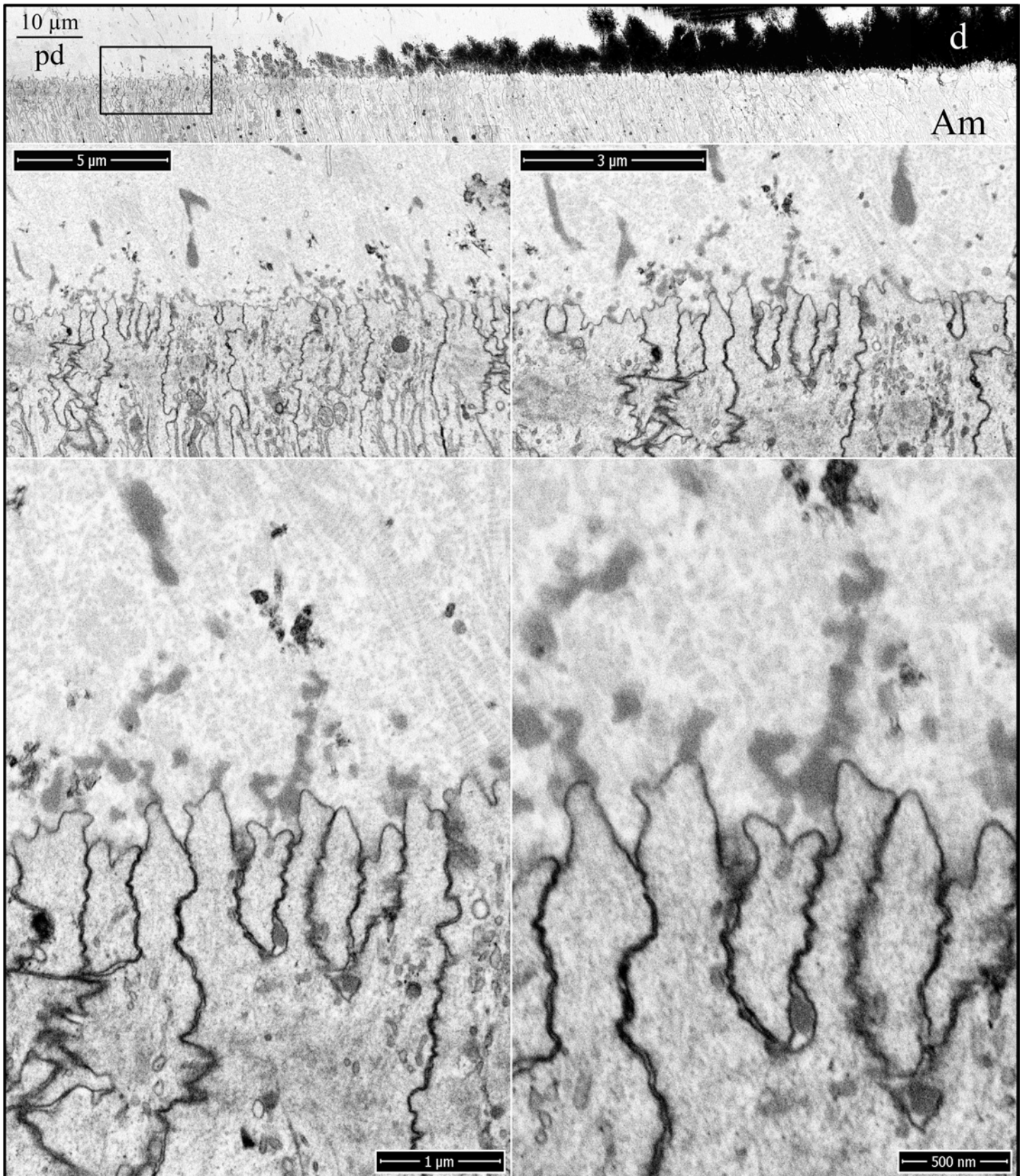
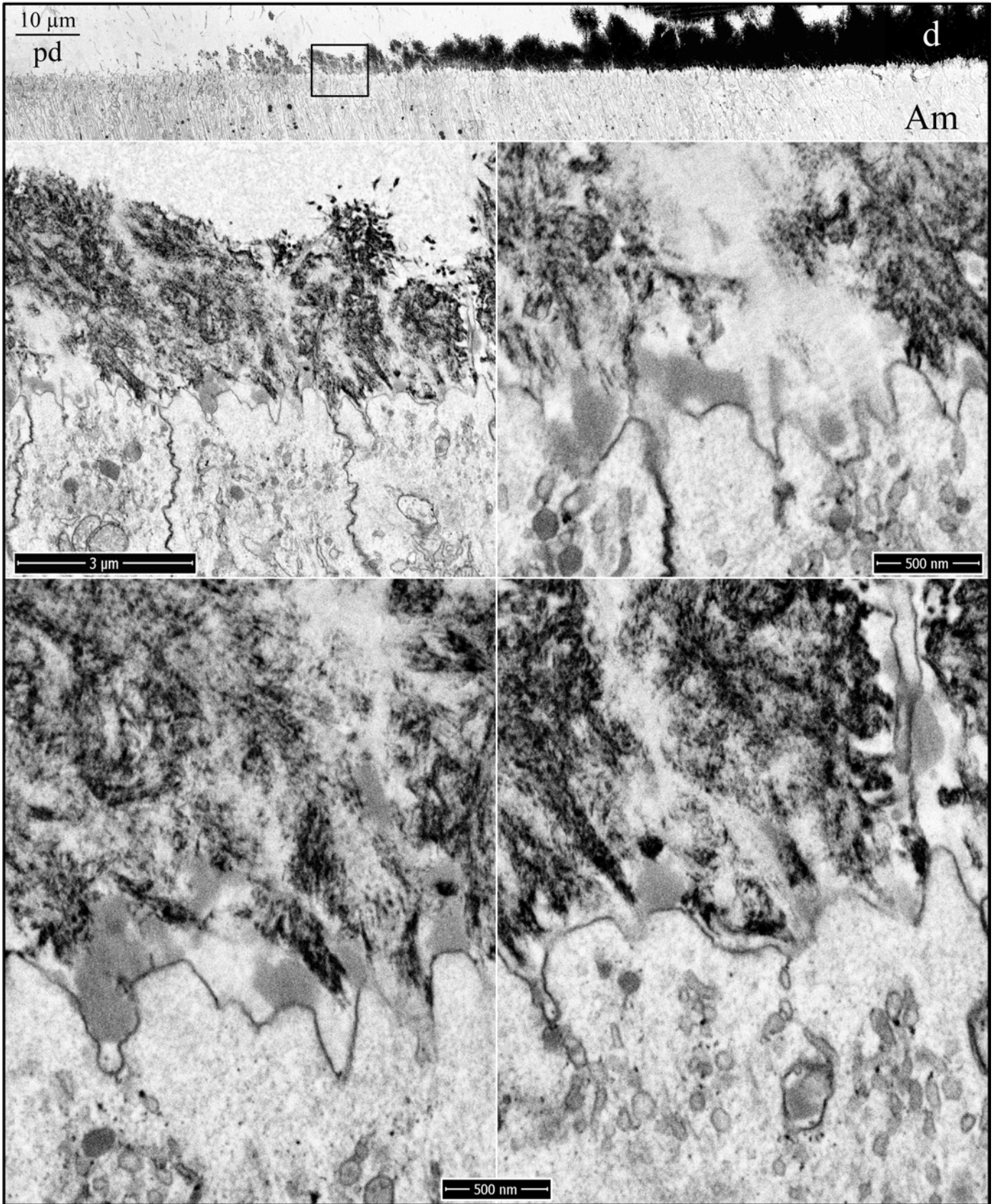


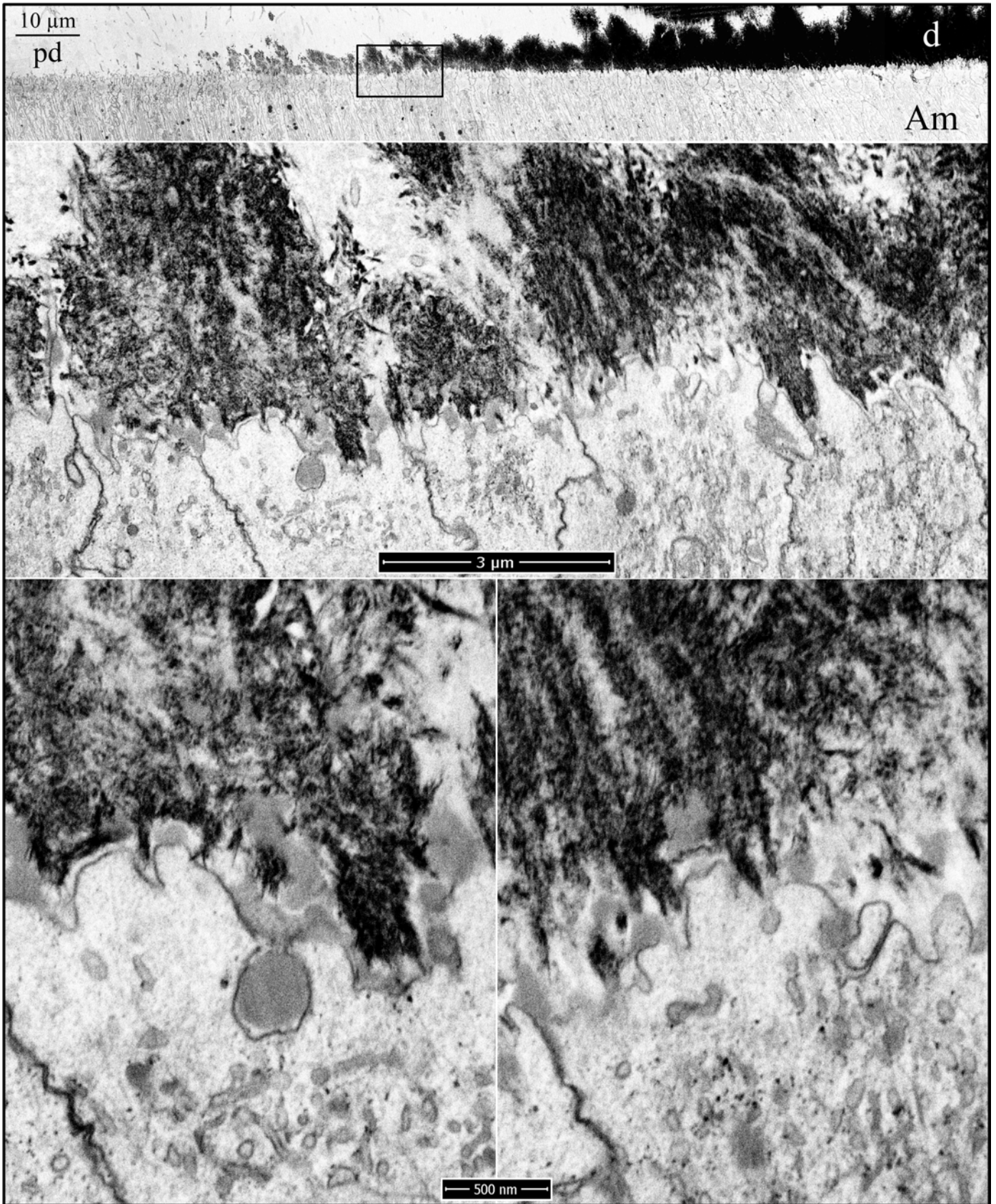
**Figure S14.** FIB-SEM images of the ameloblast-extracellular matrix interface  $\sim 1$  mm from the apical loop (box 1) in an *Ambn<sup>lacZ/lacZ</sup>* mandibular incisor. **Top:** Montage of 155  $\mu\text{m}$  wide segment taken at 5000x magnification. The box at the left shows the location of the 5000x (5  $\mu\text{m}$ ), 10000x (3  $\mu\text{m}$ ), 20000x (1  $\mu\text{m}$ ) and 35000x (500 nm) images shown below. **Key:** Am, ameloblast; D, dentin; pD, predentin. The basement membrane has been degraded and finger-like ameloblast process extend into the predentin. The darker material in the predentin matrix is mainly amelogenin.



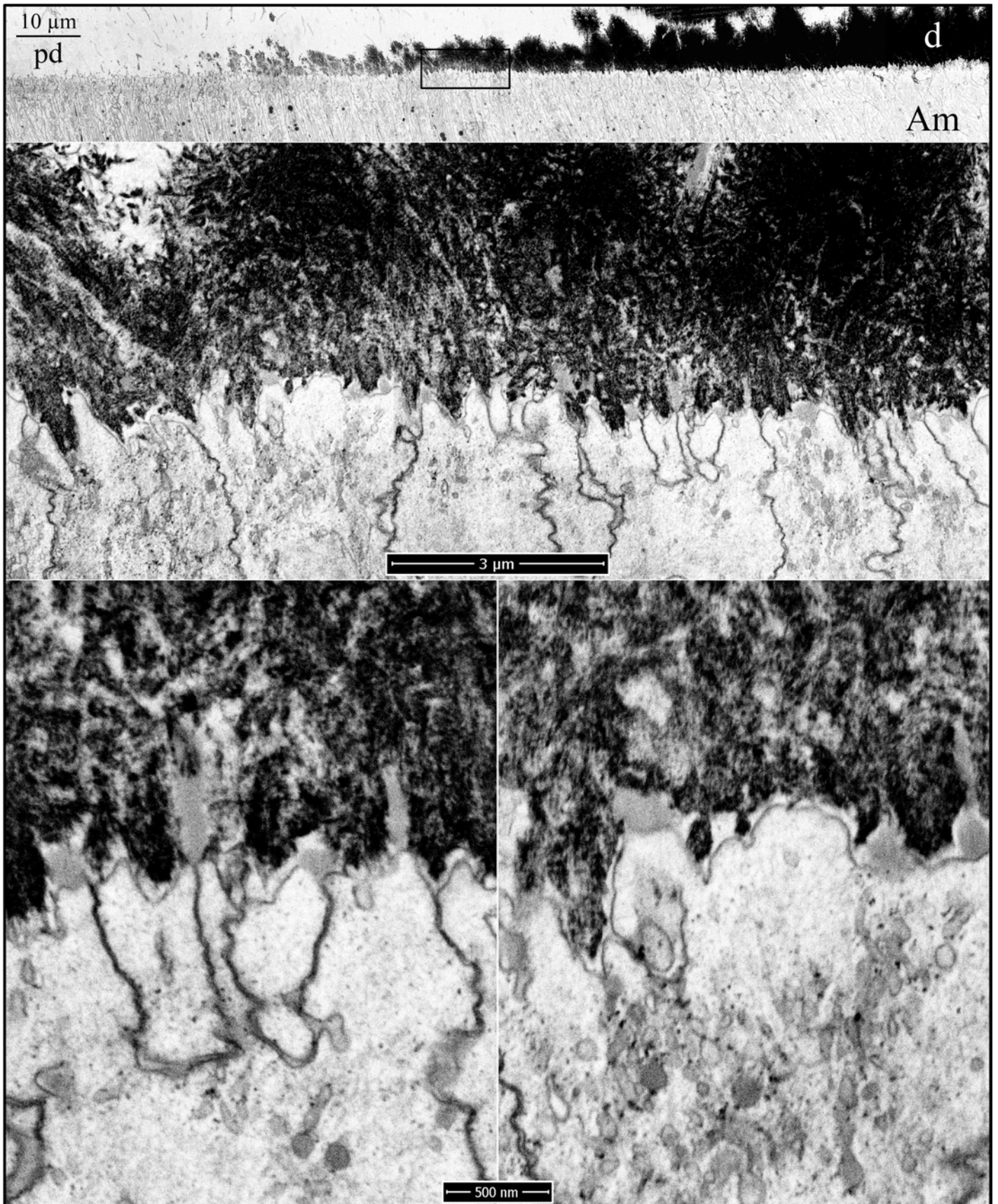
**Figure S15.** FIB-SEM images of the ameloblast-extracellular matrix interface ~1 mm from the apical loop (box 2) in an *Ambn*<sup>lacZ/lacZ</sup> mandibular incisor. **Top:** Montage of 155 μm wide segment taken at 5000x magnification. The box shows the location of the higher magnification images shown below. **Key:** Am, ameloblast; D, dentin; pd, pre-dentin. The dark mineral foci herald the onset of dentin mineralization. Many mineral foci form and will coalesce into a continuous mineral layer and expand to associate with the ameloblast finger-like projections.



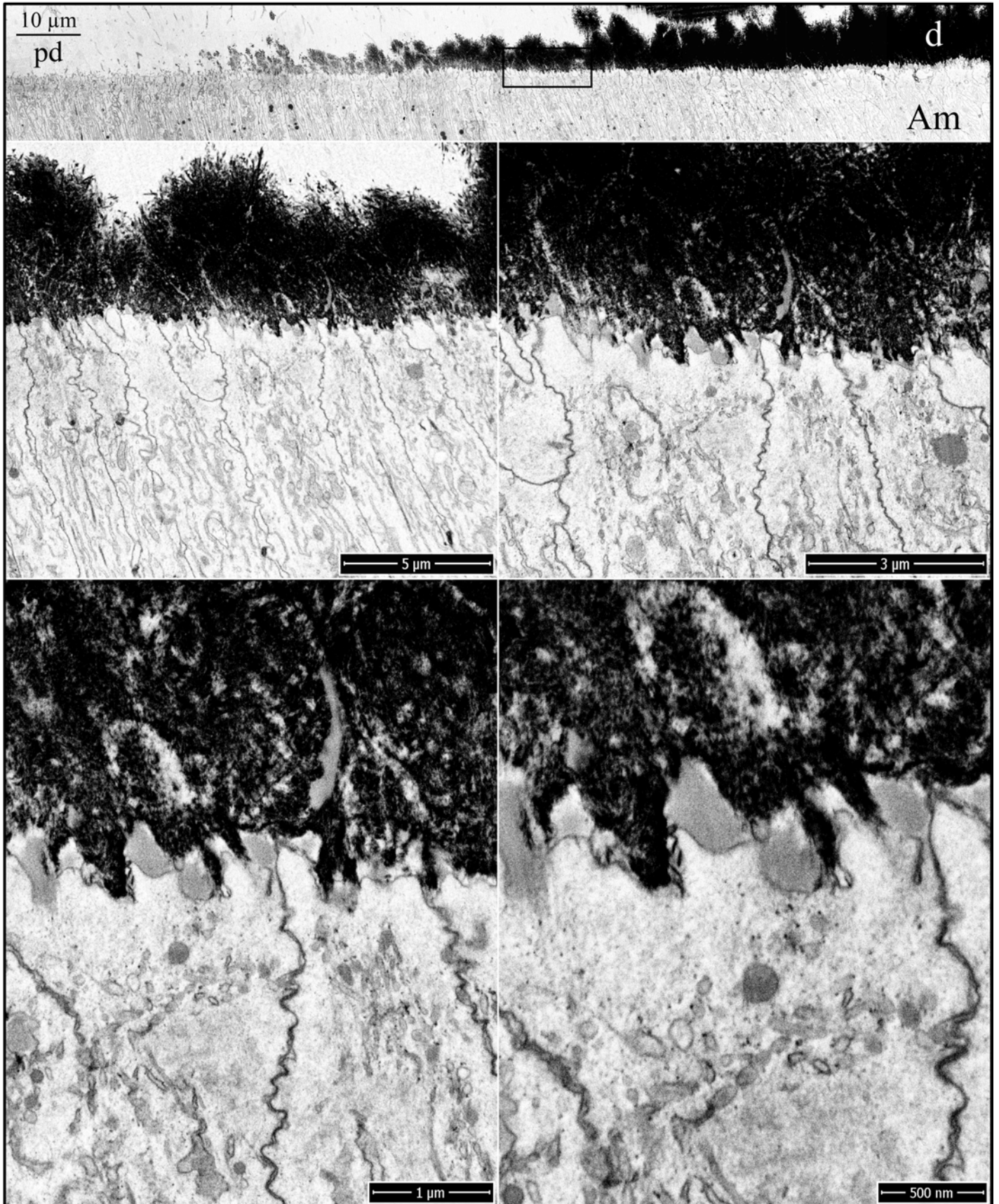
**Figure S16.** FIB-SEM images of the ameloblast-extracellular matrix interface ~1 mm from the apical loop (box 3) in an *Ambn*<sup>lacZ/lacZ</sup> mandibular incisor. **Top:** Montage of 155 µm wide segment taken at 5000x magnification. The box shows the location of the higher magnification images shown below. **Key:** Am, ameloblast; D, dentin; pD, predentin. The dentin has coalesced into a continuous mineral layer. The size and abundance of the gray patches (mostly amelogenin) on the dentin surface already exceeds what appears in wild-type incisors and is a cardinal feature of the *Ambn* null incisors.



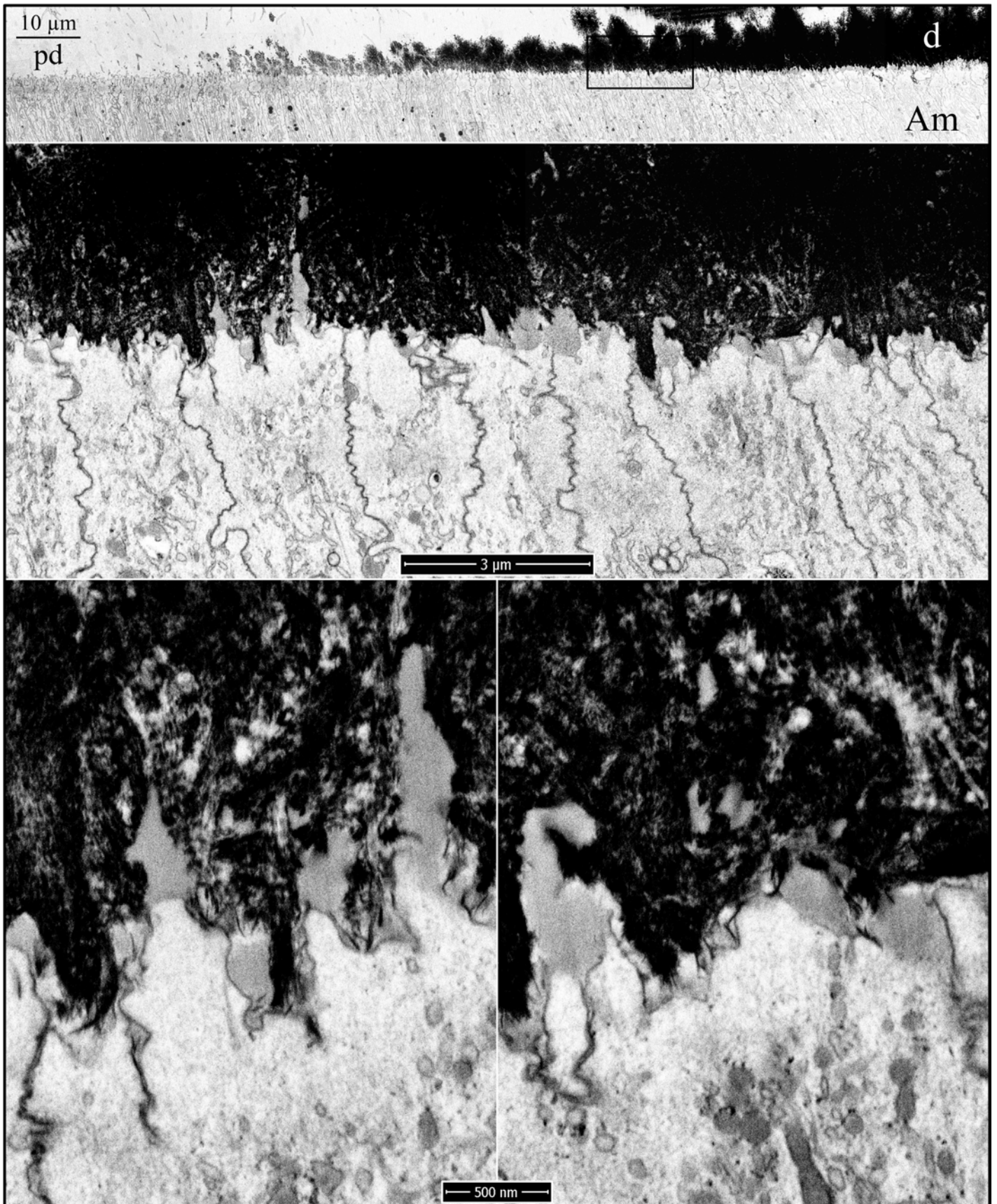
**Figure S17.** FIB-SEM images of the ameloblast-extracellular matrix interface ~1 mm from the apical loop (box 4) in an *Ambn*<sup>lacZ/lacZ</sup> mandibular incisor. **Top:** Montage of 155 µm wide segment taken at 5000x magnification. The box shows the location of the higher magnification images shown below. **Key:** Am, ameloblast; D, dentin; pd, pre-dentin. The dentin has coalesced into a continuous, highly mineralized layer. Despite this, enamel mineral ribbons have not formed and enamel protein (mainly amelogenin) accumulates.



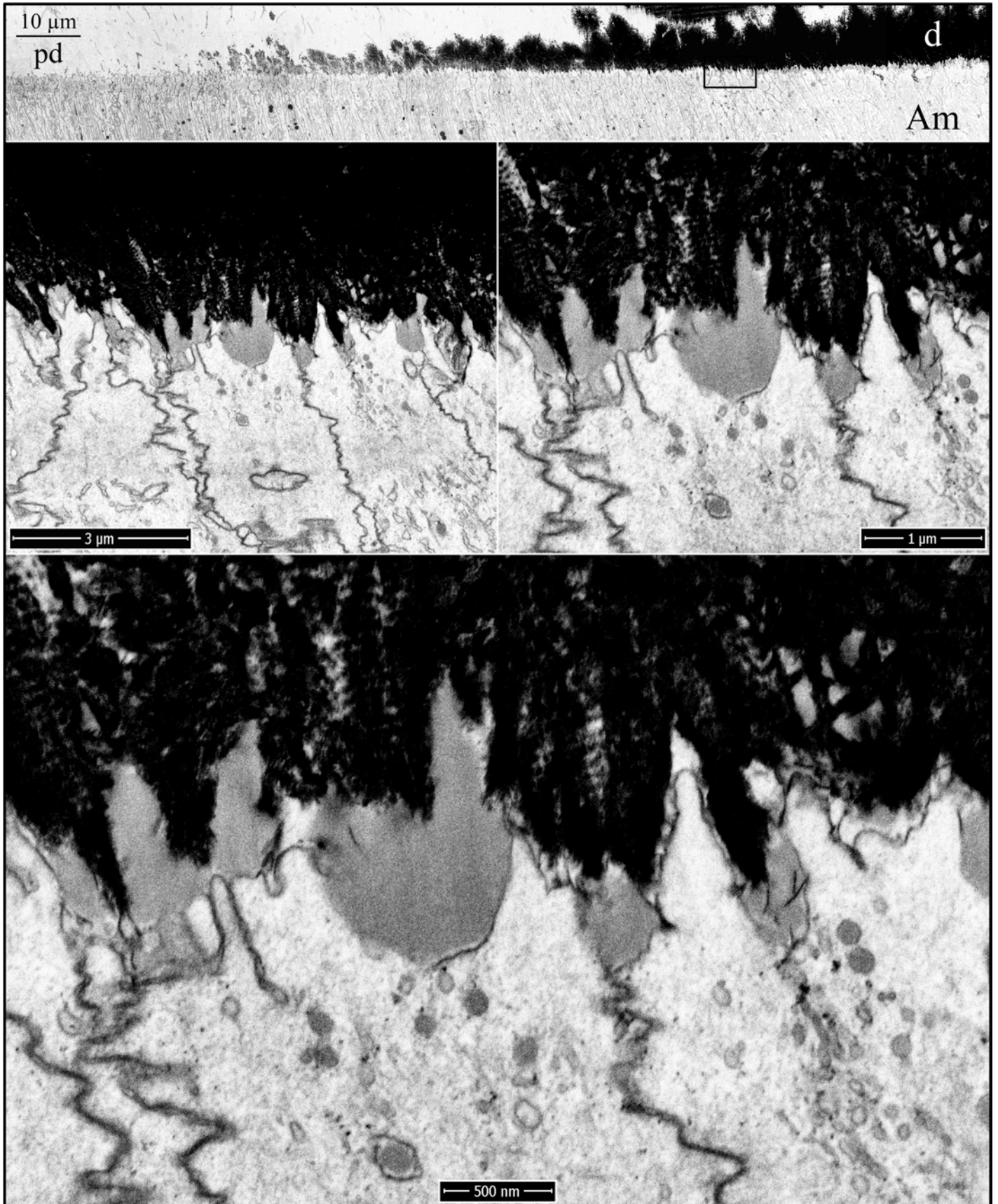
**Figure S18.** FIB-SEM images of the ameloblast-extracellular matrix interface ~1 mm from the apical loop (box 5) in an *Ambn<sup>lacZ/lacZ</sup>* mandibular incisor. **Top:** Montage of 155 µm wide segment taken at 5000x magnification. The box shows the location of the higher magnification images shown below. **Key:** Am, ameloblast; D, dentin; pD, predentin. Dentin continues to mineralize, enamel protein (mainly amelogenin) accumulates, no enamel ribbons form.



**Figure S19.** FIB-SEM images of the ameloblast-extracellular matrix interface ~1 mm from the apical loop (box 6) in an *Ambn<sup>lacZ/lacZ</sup>* mandibular incisor. **Top:** Montage of 155 μm wide segment taken at 5000x magnification. The box shows the location of the higher magnification images shown below. **Key:** Am, ameloblast; D, dentin; pD, predentin. Dentin continues to mineralize, amelogenin accumulates, no enamel ribbons form.

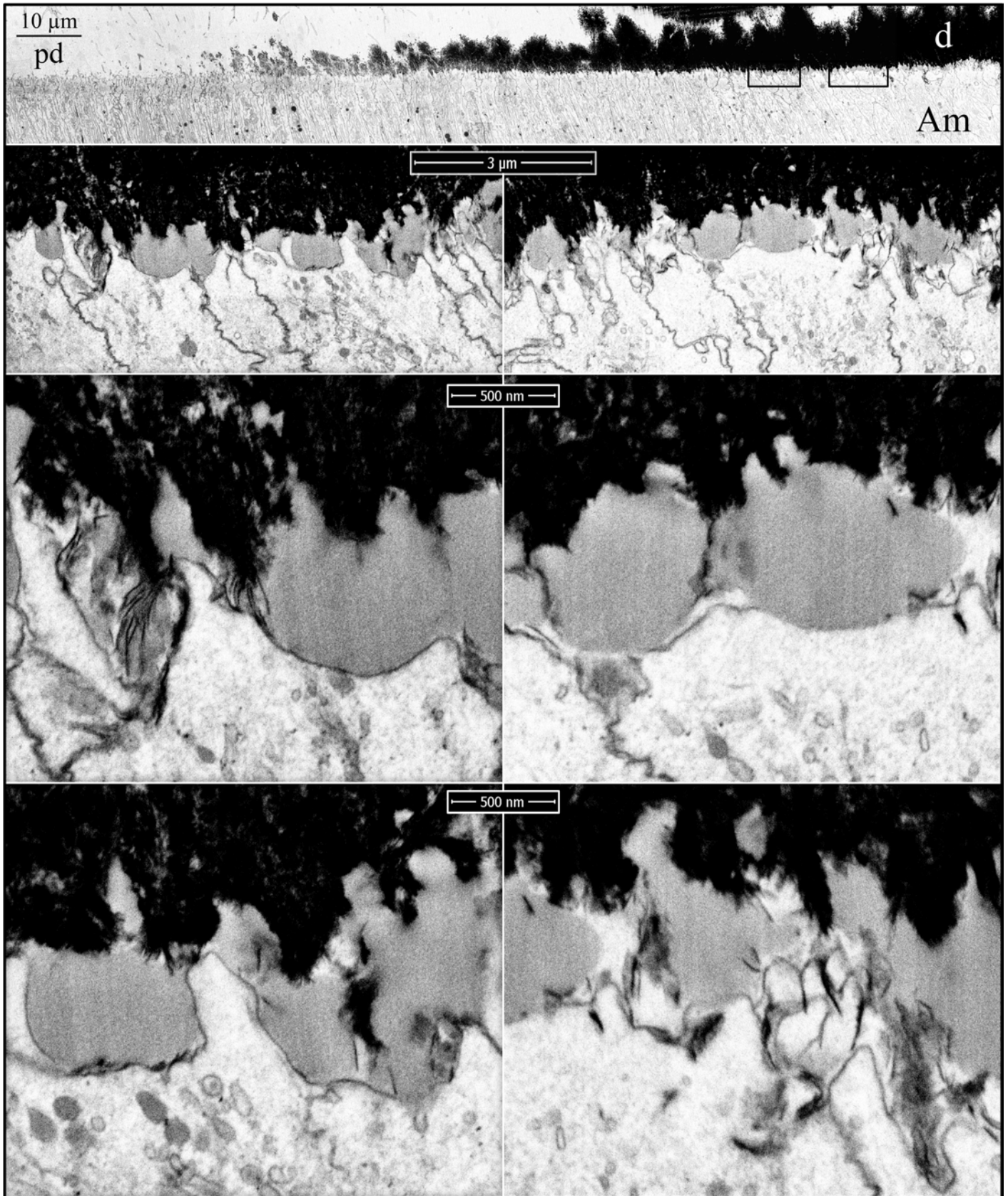


**Figure S20.** FIB-SEM images of the ameloblast-extracellular matrix interface ~1 mm from the apical loop (box 7) in an *Ambn<sup>lacZ/lacZ</sup>* mandibular incisor. **Top:** Montage of 155 µm wide segment taken at 5000x magnification. The box shows the location of the higher magnification images shown below. **Key:** Am, ameloblast; D, dentin; pD, predentin. Dentin continues to mineralize, amelogenin accumulates, no enamel ribbons form.

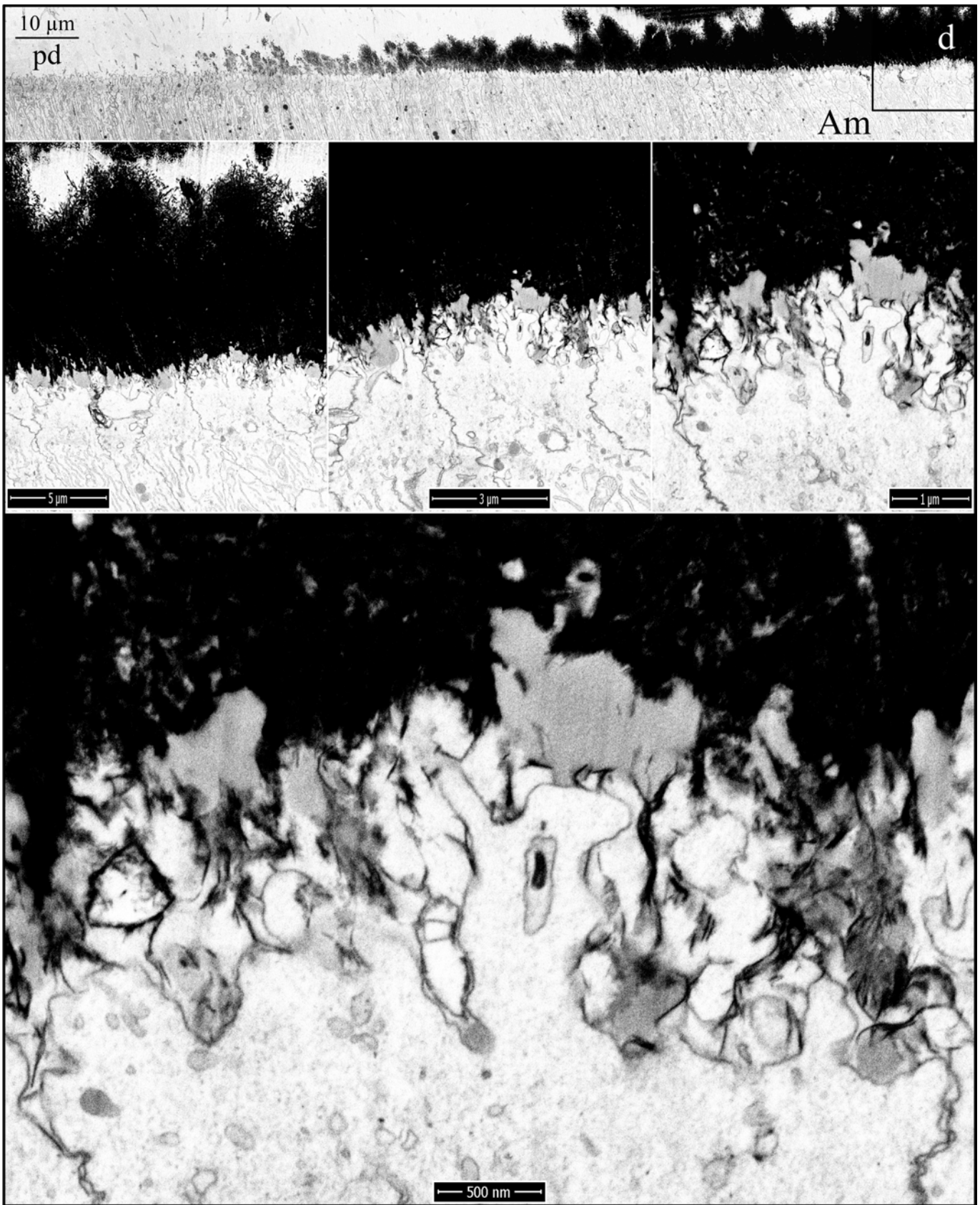


**Figure S21.** FIB-SEM images of the ameloblast-extracellular matrix interface ~1 mm from the apical loop (box 8) in an *Ambn<sup>lacZ/lacZ</sup>* mandibular incisor. **Top:** Montage of 155 µm wide segment taken at 5000x magnification. The box shows the location of the higher magnification images shown below. **Key:** Am, ameloblast; D, dentin; pD, predentin. Dentin continues to mineralize, amelogenin accumulates, no enamel ribbons form.





**Figure S22.** FIB-SEM images of the ameloblast-extracellular matrix interface ~1 mm from the apical loop (box 9) in an *Ambn*<sup>lacZ/lacZ</sup> mandibular incisor. **Top:** Montage of 155 μm wide segment taken at 5000x magnification. The box shows the location of the higher magnification images shown below. **Key:** Am, ameloblast; D, dentin; pD, predentin. Dentin continues to mineralize, amelogenin accumulates, no enamel ribbons form. Some curved ribbon-like mineral is deposited near the surface of ameloblast distal membrane.



**Figure S23.** FIB-SEM images of the ameloblast-extracellular matrix interface ~1 mm from the apical loop (box 10) in an *Ambn<sup>lacZ/lacZ</sup>* mandibular incisor. **Top:** Montage of 155 µm wide segment taken at 5000x magnification. The box shows the location of the higher magnification images shown below. **Key:** Am, ameloblast; D, dentin; pD, predentin. Dentin continues to mineralize, amelogenin accumulates, no enamel ribbons form. Some curved ribbon-like mineral is deposited near the surface of ameloblast distal membrane.