

Figure 6.7 Ultra-thin section of crystalline crumb chocolate.

6.6.1 Crystallinity

Figure 6.7 shows the microstructure of a typical highly crystalline chocolate particle obtained from crumb. It is evident that a composite crumb particle is present where sugar crystals are surrounded by milk protein particles at the edge with randomly positioned cocoa fragments.

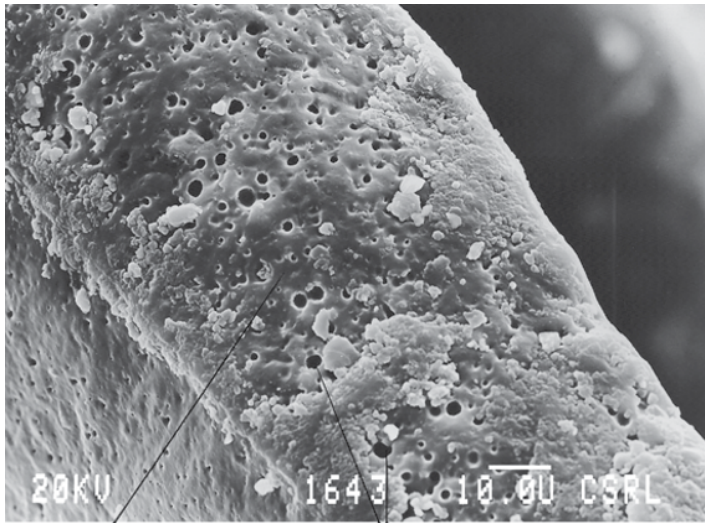
When significant quantities of glucose syrup are present in the formulation before going through the drying process, a highly amorphous crumb is the result. This occurs with “rework” crumb, whose structure is depicted in Figure 6.8.

6.6.2 Fat availability

If a freeze etch picture is taken of a fracture through such an amorphous crumb, trapped fat globules can be seen within the amorphous sugar matrix (Figure 6.9). This would not be seen in a significant amount in a highly crystalline crumb.

6.6.3 Fat droplet size

Another significant structural factor affected by crumb processing is the size of the fat globules. The original batch oven process added cocoa liquor at a late stage, that is after making sweetened condensed milk. The degree of mixing did not disperse the cocoa butter from the liquor very finely so that, during later chocolate refining, size reduction to about 25 μm was able to release the fat fairly readily (see also Chapter 3). If, however, cocoa liquor is added to the original milk and sugar before evaporation, its cocoa butter is finely dispersed within the crumb structure and is not so easy to release in refining. This is even more the case in a process where a spray nozzle is used to disperse the liquor/sweetened condensed milk into a drying chamber.

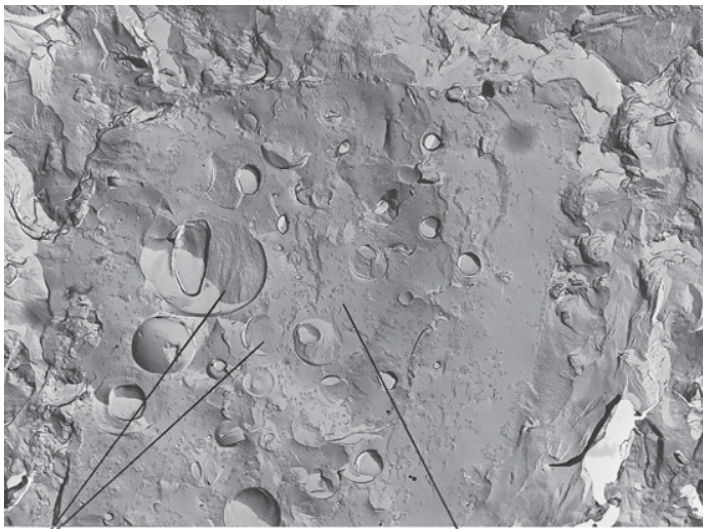


Amorphous matrix

Pore holes

× 1250 mag.

Figure 6.8 Section of amorphous (glassy) crumb.



Fat droplets

Amorphous sugar

× 10 000 mag.

Figure 6.9 Scanning electron microscope picture of freeze etch fracture through amorphous crumb.

6.6.4 Aeration

Original batch oven crumb had a honeycomb texture created by the evaporation of moisture from the stiff kneader paste under vacuum. This made the crumb easy to fracture and easy to mill and refine. This structure is harder to produce