



**Fig. 11** **a** SEM image of subsurficial cross section of living cyanobacterial mat taken from c. 4 m water depth (sample A-48). The topmost part of the section is composed of aragonite (*Ara*) passing downward into hydromagnesite (*Hmg*). **b**, **c** EDS maps for Ca

and Mg of the same section. **d** SEM image of magnified part of the hydromagnesite zone from (a). **e**, **f** EDS maps for Mg and Si of the same section. **g**, **h** X-ray diffractograms of the aragonite (**g**) and hydromagnesite (**h**) mineral zones shown above

#### Radiometric ( $^{238}\text{U}/^{230}\text{Th}$ ) dating of microbialites

The “brown” and the “white” microbialites were dated by the  $^{238}\text{U}/^{230}\text{Th}$  disequilibrium method (Bourdo et al. 2003) (courtesy A. Mangini, Heidelberg). Sample A19 (Heidelberg lab.# 4729) “white” microbialite yielded a corrected age of  $2.81 \pm 0.31$  ka, and sample A14 (Heidelberg lab.# 4728) “brown” microbialite yielded a corrected age of  $1.128 \pm 0.075$  ka. These results are in accordance with stratigraphic order, i.e., the “brown” generation is overgrowing the “white” generation. The “brown” facies contains ten times as much U ( $^{238}\text{U}$  1.36 compared to  $0.14 \mu\text{g g}^{-1}$ ) and 100 times more  $^{232}\text{Th}$  ( $^{232}\text{Th}$  25.46 compared to  $0.24 \text{ ng g}^{-1}$ ) and  $^{230}\text{Th}$  0.451 compared to  $0.090 \text{ pg g}^{-1}$ ) as the “white” generation, thus illustrating the higher mobilization of U and Th during the “brown” facies in correlation with the high-stand of the lake during that time (see below).

#### Results of microscopic examination of “white” microbialites

The emerged “white” microbialites appear to be identical in texture with those presently mineralizing below water. Petrographic vertical thin-sections of these current microbialites show that below the living cyanobacterial mat, a thin layer of brownish micritic aragonite is present. This layer grades downward into more transparent, i.e., crystalline hydromagnesite (Fig. 12). The micritic aragonite layer is usually indistinctly microlaminated whereas the hydromagnesite is typically almost structureless or irregularly reticulate (Fig. 12a).

Observations of the air-dried surface of the living cyanobacterial films with scanning electron microscopy (SEM) revealed that during the first stages of the mineralization of the mat aragonite nanograins are precipitated in