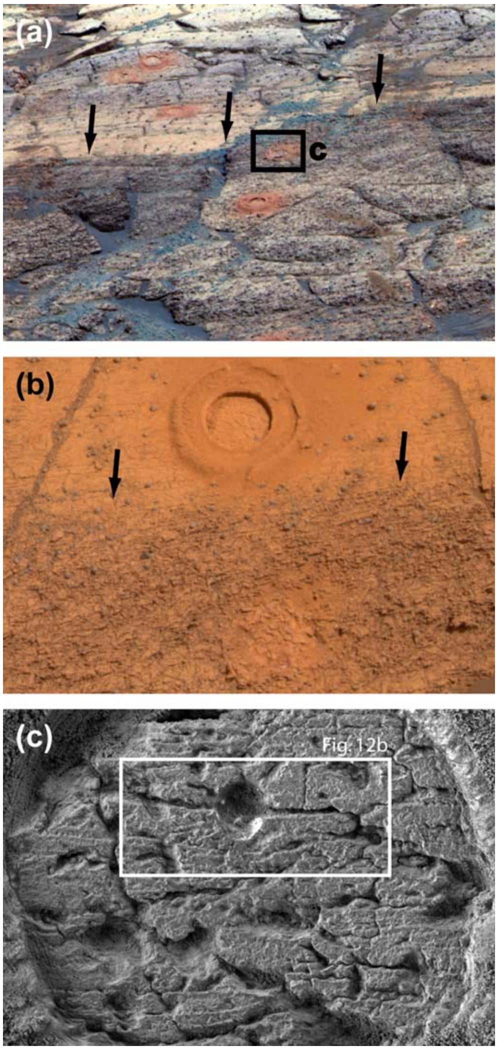

Fig. 6. (a) Close up of false color Pancam mosaic of the Burns formation in the vicinity of the Karatepe ingress path showing the distinct color change associated with the Whatanga contact (arrows), marking the boundary between the middle and upper units. Scale can be estimated from RAT holes, which are 4.5 cm in diameter. Images used in this mosaic were taken on Sol 173, sequence P2401 using 750 nm, 530 nm and 430 nm filters. (b) Close up of true color (best estimate) Pancam image of the Whatanga contact (arrows point to top of contact zone) in the vicinity of Burns Cliff. Note that laminations are highly obscured at the dark contact. Scale can be estimated from the 4.5 cm diameter RAT hole. Image was taken on Sol 310 at 12:36:29 LTST, sequence P2558, using 750 nm, 670 nm, 600 nm, 530 nm, 480 nm and 430 nm filters. (c) Close up of MI mosaic of abraded rock surface (Grindstone) taken within the Whatanga contact at the Karatepe stratigraphic section on Sol 152. Location is marked by box in (a). Note that primary stratification and grain boundaries are obscured by recrystallization and formation of secondary porosity. Also note the greatly enlarged size of the pores in the bottom half of the image. The white box shows the location of Fig. 12b.

stratigraphically controlled process that affects the intensity of diagenetic alteration. Although primary stratification is largely obscured, Grotzinger et al. [2] noted that there is no indication of facies variations in this part of the stratigraphic section and accordingly interpreted these zones of recrystallization to be the position of the top or capillary fringe of a stagnant paleo-water table, and thus diagenetic fronts.

At the top of the El Capitan outcrop in Eagle crater (Guadalupe) and in a single cobble on the Meridiani plains just outside Endurance crater (Lion Stone) RATed surfaces exposed apparently crystalline material (Fig. 5i) but with both spherules and crystal molds preserved (see Fig. 11d below). Resistance to grinding by the RAT indicates that this material is significantly harder than any other rocks encountered in the Burns formation [22]. Two possible interpretations may explain this texture. The first is that this represents a much higher degree of intergranular pore-filling cement that eliminated most of the primary porosity and thus is essentially an extreme version of cement type 1 described above. The second possibility is that this is a later pore-occluding cementing process involving recrystallization. In either case, it is worth noting that the primary sedimentary fabric (sand–silt laminations, grain boundaries) preserved on abraded surfaces at Guadalupe and Lion Stone is also much more poorly expressed than at other outcrops (see Fig. 11c below). The chemical and mineralogical composition of RATed surfaces is similar to other abraded outcrop samples [25] indicating that the processes did not introduce a significant amount of material with a composition significantly different to the main outcrops.

5.2. Spherules

Dispersed throughout the outcrop are abundant spherules (informally named “blueberries”) of relatively uniform shape and size (Fig. 7). The spherules do not appear to disrupt laminations in any significant way (Fig. 7a,b). They typically weather out of the outcrop by physical aeolian erosion and form a lag deposit on the plains surface [50] indicating that they are far more physically robust than the surrounding outcrop (Fig. 7c,d). The sizes of spherules embedded within the outcrop are rather uniform with a mean diameter of 4.2 mm (standard deviation, s.d. = 0.8 mm; 454 spherules). The spherules are almost perfectly spherical with aspect ratios averaging 1.06 (s.d. = 0.04). Volumetric densities of spherules were estimated at three locations (Shoemaker’s Patio at Eagle crater, Fram crater and in the upper unit at the Karatepe section in Endurance