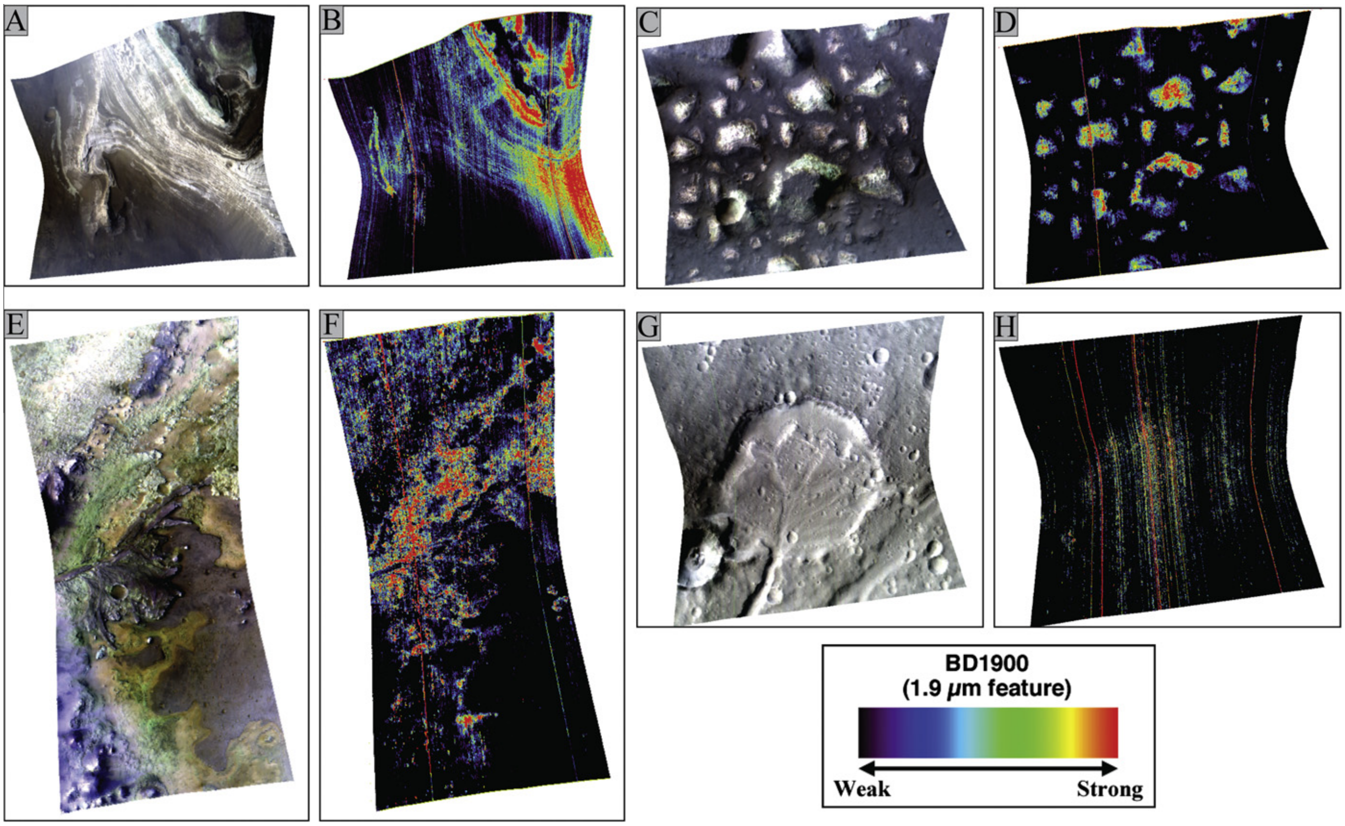

Fig. 9. CRISM observations showing the association between exposed open-basin lake deposits and aqueous alteration minerals, indicated by the BD1900 parameter (B, D, F, H), which relates to the strength of the 1.9 μm absorption (Pelkey et al., 2007). Stretch for all CRISM false color RGB images (A, C, E, G) is R = 2.3906 μm, G = 1.8904 μm and B = 1.1521 μm. Scale for the parameter values is indicated in the lower right. (A) FRT0000622B showing layering in an open-basin lake in Terby Crater, 28.25°S, 73.68°E (Wilson et al., 2007). (B) BD1900 parameter for FRT0000622B indicating the presence of hydrated minerals in the deposit shown in part (A) (Ansan et al., 2011). (C) FRT00008C90 showing exposed floor material in an open-basin lake at 30.12°S, 176.56°E (Irwin et al., 2002). (D) BD1900 parameter for FRT00008C90 indicating the presence of hydrated minerals in the deposit shown in part (C) (Wray et al., 2009). (E) HRL000040FF showing a delta deposit in an open-basin lake in Jezero Crater, 18.38°N, 77.70°E (Fassett and Head, 2005; Ehlmann et al., 2008a). (F) BD1900 parameter for HRL000040FF indicating the presence of hydrated minerals in the deposit shown in part (E) (Ehlmann et al., 2008a). (G) FRT000098B5 showing a delta deposit in an open-basin lake at 8.54°N, 48.00°W (Harrison and Grimm, 2005; Hauber et al., 2009). Note the lack of spectral diversity across the deposit. (H) BD1900 parameter for FRT000098B5 indicating the lack of hydrated minerals in the deposit shown in part (G).

work has shown that some martian paleo-lacustrine deposits do contain aqueous alteration and evaporite minerals (e.g. Ehlmann et al., 2008a, 2008b, 2009; Mustard et al., 2008; Dehouck et al., 2010; Ansan et al., 2011), our results indicate these occurrences are limited (~29% of exposed deposits of possible lacustrine origin with CRISM coverage have mineralogies that reflect aqueous alteration). Additionally, the only site with observed evaporite deposits (carbonate) is in Jezero crater, where it has been shown that the observed carbonate and Fe/Mg-smectite are present as transported material (Ehlmann et al., 2008a, 2008b).

These results indicate a divergence from the mineral assemblages that would be predicted for martian lacustrine deposits based on the study of terrestrial lacustrine systems (e.g. Moore, 1961; Thomas, 1969; Muller and Quakernaat, 1969; Singer et al., 1972; Thomas et al., 1972, 1973; Jones and Bowser, 1978; Blatt et al., 1980; Hillier, 1993), and could be due to three possible scenarios: (1) thin resurfacing units, such as aeolian dust cover, obscuring aqueous alteration and evaporite minerals within the exposed deposits from spectral detection and characterization from orbit; (2) available and currently analyzed spectral data at adequate resolution over these exposed deposits are too few in number to discern true trends; or (3) many exposed open-basin lake deposits have a lithology that is primarily composed of unaltered material.

Clearly, the first two mechanisms cannot be ruled out and could be contributing to the observed disparity. For the first mechanism in particular, there does seem to be some correlation between exposed open-basin lake deposits containing identified aqueous alteration minerals and fairly dust free areas indicated by a global dust cover index (Ruff and Christensen, 2002) (Fig. 11); however, there are a large number of exposed open-basin lake deposits also in these dust free areas that show no evidence for the presence of aqueous alteration minerals. Furthermore, we have identified aqueous alteration minerals in exposed open-basin lake deposits where there is both substantial regional dust cover as well as in areas that are largely dust free (Ruff and Christensen, 2002) (Fig. 11). It is important to note that the scale of the Ruff and Christensen (2002) dust cover index is much larger than the scale of many of the exposed sedimentary deposits examined here, and so more local dust cover might be present at those sites deemed to be dust free; however, we hypothesize that it is doubtful that a spectrally obscuring dust unit is the only cause for the disparity identified here, although it may be a contributing factor. Additionally, 34 of the 79 (~43%) exposed open-basin lake deposits have CRISM targeted observation coverage at a resolution that is adequate for identifying aqueous alteration and evaporite minerals (Table 2) (e.g. Ehlmann et al., 2008a, 2008b, 2009; Mustard et al., 2008; Dehouck et al., 2010); however, only 10 (~29% of the deposits with adequate spectral coverage) exposed deposits have such identified minerals. Therefore, it is doubtful that insufficient CRISM coverage is the only cause of the observed disparity. The final hypothesis that most open-basin lake deposits have an unaltered