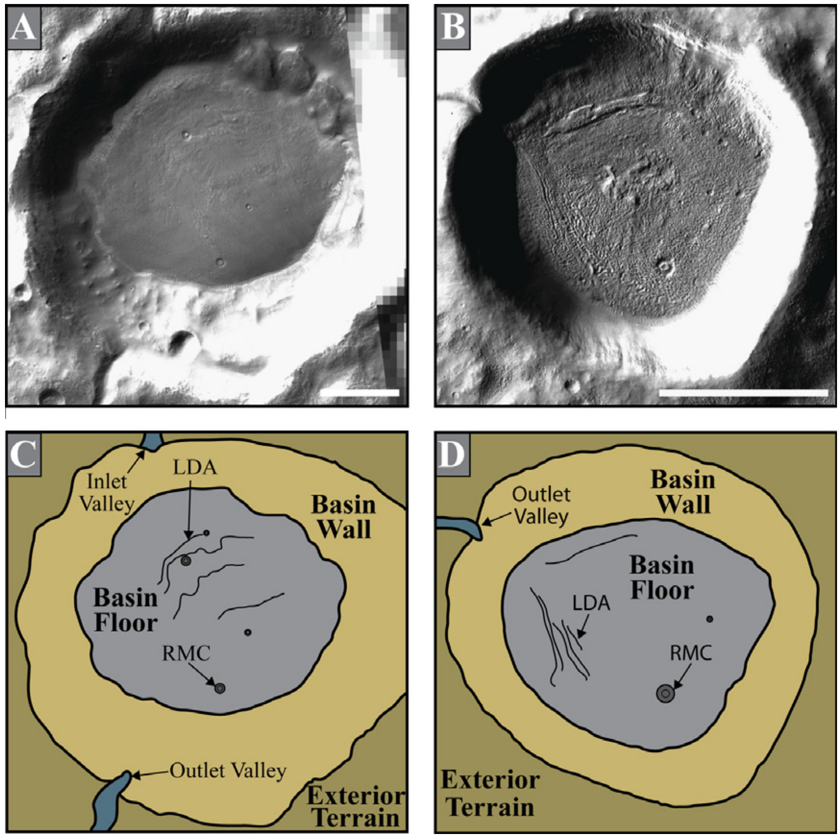

Fig. 5. Examples of glacially resurfaced open-basin lakes. Scale bars are 2 km. (A) Glacially resurfaced open-basin lake at 38.91°S, 102.96°W (Fassett and Head, 2008a). CTX image P15_006798_1405_XI_39S103 W overlain on THEMIS visible mosaic. (B) Glacially resurfaced open-basin lake at 36.24°S, 124.42°W (Fassett and Head, 2008a). CTX image B02_010596_1432_XN_36S124 W. Note that this is an unusual open-basin lake that lacks obvious input valleys. (C and D) Geologic sketch maps of the glacially resurfaced open-basin lakes in parts (A and B) respectively. Ring-mold craters (RMCs) and lobate debris aprons (LDAs) are indicated.

position controlled by the relative proportions of Fe and Mg (Bishop et al., 2002).

The identification of kaolinite is based on a strong hydroxyl overtone at 1.4 μm and a doublet absorption at 2.16 and 2.20 μm, as well as a weak absorption at 1.9 μm (Fig. 10). As with smectite, the 1.4 and 1.9 μm absorptions are due to an overtone and combination tone of fundamental absorptions of bound OH and H_2O respectively (Clark et al., 1990), while the 2.16 and 2.20 μm doublet is caused by combination tones of fundamental absorptions of Al–OH in the kaolinite structure (Clark et al., 1990).

Hydrated silica is identified based on diagnostic absorptions at 1.4 and 1.9 μm and a broad absorption centered at ~2.2 μm (Fig. 10). The bands at 1.4 and 1.9 μm are again related to fundamental absorptions from bound OH and H_2O, while the broad 2.2 μm absorption is caused by combination tones of fundamental absorptions from the Si–OH bond (Stolper, 1982).

Carbonate is identified based on paired absorptions at 2.31 and 2.51 μm, as well as an absorption at 1.9 μm (Fig. 10). The paired absorptions at 2.31 and 2.51 μm are caused by overtones of fundamental carbonate absorptions, while the 1.9 μm band is caused by a combination tone of fundamental absorptions of structurally bound H_2O (Hunt and Salisbury, 1971; Gaffey, 1987).

4. Implications of the global distribution of open-basin lake characteristics

Several interesting observations arise from the global distribution of features and processes implied by the classification presented here (Figs. 7 and 8). First, it is clear that there is a distinctly higher density of open-basin lakes with exposed sedimentary deposits in the Nili Fossae region (Fig. 7, outlined area). Indeed, all of the open-basin lakes previously identified in Nili Fossae contain some form of exposed deposit of possible lacustrine origin (Fig. 7; compare to Fig. 1 in Fassett and Head (2008a)). Two scenarios that might explain this observation are: (1) this area has been exhumed, leading to an exposure of the original sedimentary deposits within the open-basin lakes and/or (2) this area had a higher sediment load during open-basin lake lacustrine activity or was active for a longer period of time, thus creating thicker sedimentary deposits, which have been preferentially preserved and remain exposed. Although both of these mechanisms are possible, the exposed open-basin lake deposits in Nili Fossae are commonly observed below a partially eroded resurfacing unit, which is in agreement with previous work that cites exhumation as a dominant geologic process in this area (e.g. Mangold et al., 2007; Mustard et al., 2007; Harvey and Griswold, 2010). The magnitude of exhumation in the Nili Fossae region is also likely to have been substantial, as enough material has been eroded, possibly due to aeolian activity (Mangold et al., 2007), to expose ancient Noachian crustal material (Mangold et al., 2007; Mustard et al., 2007). Therefore, we tentatively favor the hypothesis of exhumation as the most plausible explanation for the high density of exposed sedimentary deposits in the Nili Fossae region.

The distribution shown by the resurfacing classification also reveals some interesting trends (Fig. 8). While the large number of volcanically resurfaced open-basin lakes (96; ~42%) is not surprising due to the fact that at least ~30% of the martian surface has been resurfaced by Hesperian volcanic flows (Head et al., 2002), the locations of the volcanically resurfaced open-basin lakes are interesting. Although many of the volcanically resurfaced open-