Supplementary Material

Table S1: *Requirements for spectrally neutral terrain used to create average neutral spectra for ratioing purposes, with parameters (defined by Viviano-Beck et al., 2014) listed for each cube for which spectra are shown. Mineral mask is used to produce spectra shown in main text, but the dust mask is a viable alternative, as shown in Figure S1.*

Parameter	**FRT47A3**	**FRT5C5E**	**FRT5850**	**FRT1182A**	**HRL40FF**
Mineral Mask					
R770	> 0.01	> 0.01	> 0.01	> 0.01	> 0.01
BDI1000IR	< 0.035	< 0.02	< 0.015	< 0.035	< 0.035
OLINDEX3	< 0.09	< 0.09	< 0.07	< 0.09	< 0.12
BD1300	< 0.02	< 0.02	< 0.005	< 0.02	< 0.02
LCPINDEX2	< -0.03	< -0.02	< -0.015	< -0.025	< -0.03
HCPINDEX2	< 0	< -0.01	< -0.005	< 0	< 0
D2200	< 0.005	< 0.005	< 0.002	< 0.005	< 0.005
BD2290	< 0	< 0.005	< 0.002	< 0.004	< 0.005
D2300	< 0.005	< 0.005	< 0.002	< 0.005	< 0.005
BD2500_2	< -0.005	< -0.005	< -0.005	< -0.005	< -0.005
Pixels selected	*3,458*	*16,113*	*10,568*	*21,930*	*1,200*
Dust Mask					
R770	> 0.01	> 0.01	> 0.01	> 0.01	> 0.01
RBR	> 3.8	> 3.4	> 3.5	> 3.5	> 3.5
RPEAK1	> 0.73	> 0.73	> 0.725	> 0.725	> 0.73
BD2500_2	< -0.005	< -0.005	< -0.005	< -0.005	< -0.005
Pixels selected	*2,490*	*2,148*	*1,353*	*1,471*	*10,577*

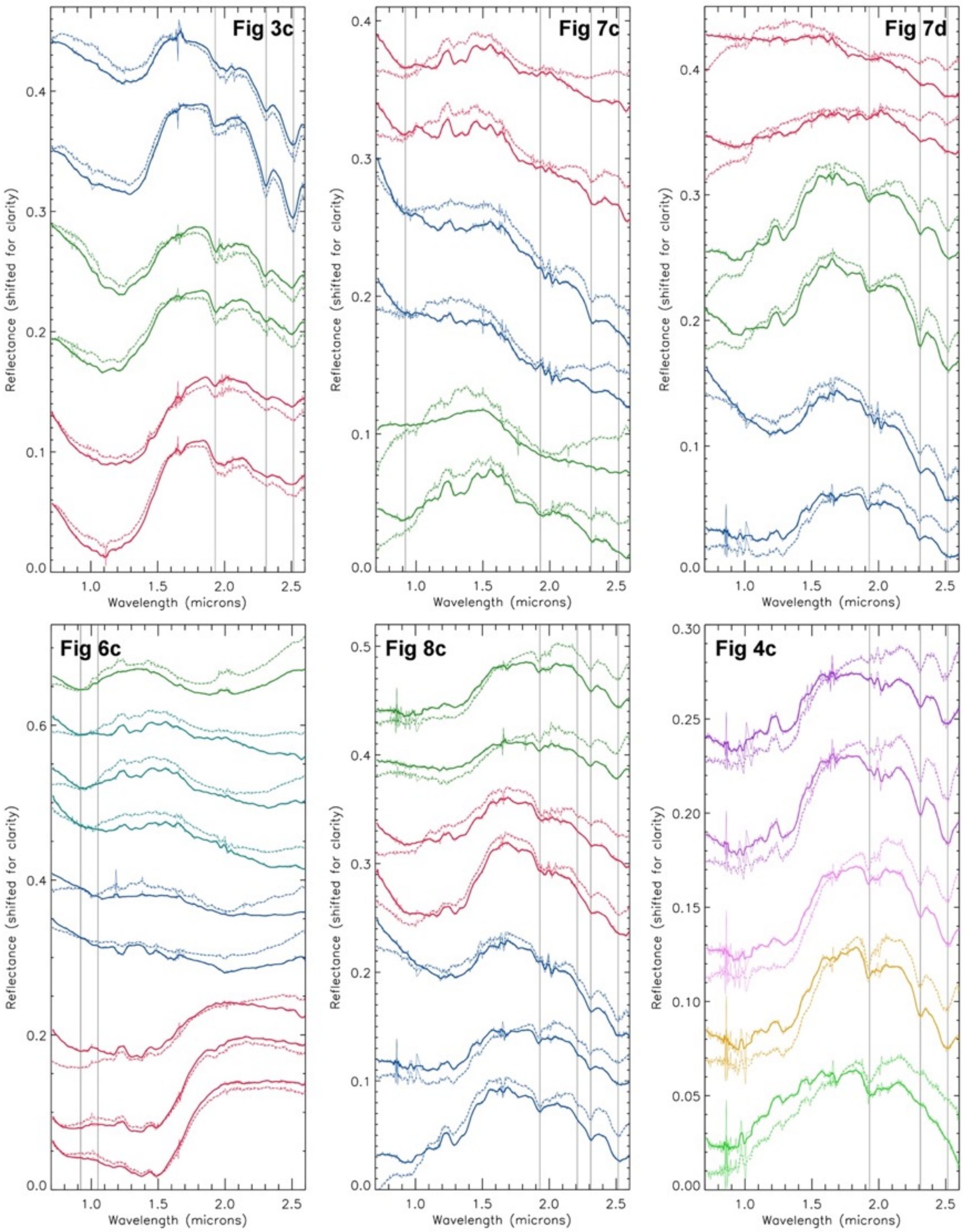

Figure S1: *Comparison of ratio spectra produced via mineral mask (dashed line) and via dust mask (solid line), as detailed in Table S1. Each plot is equivalent to figure in main text as labeled. Mineral mask-derived spectra are used in main text, as it tends to produce clearer 2.5 µm bands.*

Table S2: *Summary of marginal carbonate deposits in terrestrial, modern and recent, endorheic, perennial lakes. Brackets indicate ranges.*

	Location	*Lake*	*Hydrogeological Context*	*Surface (km^2)**	*Elevation (m)*	*Latitude*	*Salinity (g/L)*	*Alkalinity (meq./L)***	*pH*	*Age (kyrs)*	*Types of Marginal Carbonates*	*Carbonate Mineralogy*	*References*
Alkaline Lakes	Tanzania	Lake Natron	Rift System; precambrian basement rocks; active volcanoes (carbonatites); hot springs	950	600	02°25'S	340	5.5533	[9.0-11.5]	[240-10]	Lagoonal laminites of peloids; cemented crusts of springs seeps (pebble, planar, cylindrical encrustations); oncoids; stromatolitic bioherms	Aragonite; dolomite	Warren 2006; Casanova 1994
	Kenya	Bogoria Lake	Rift System; volcanic and sedimentary rocks upon metamorphic basement; hot springs	36	990	0°15'N	[29.2-38.8]	[115-8,775]	[9.6-10.6]	[5.3-4.8]	Hot-spring travertines (hydrothermal chimneys); Regular stromatolites	Aragonite, Low-Mg calcite; calcite	Thiercelin & Vincens 1987; Jones & Renaut 1996
	Western US	Mono Lake	Volcanic active area ; aerial inflows and resurging ground waters	184	1950	38°01'N	90	458	9.8	Holocene/Modern	Tufa mounds and pinnacles	Calcite/ikaite; aragonite	Warren 2006; Shearman et al., 1989
	Turkey	Lake Van	Mafic volcanic active area; seep water discharges	3.80	1730	38°38'N	22	[146-153]	[9.5-9.8]	Holocene/Modern	Tower-like microbialites; Fine-grained (whitings)	Aragonite/calcite (ikaite?)	Kazmierczak et al 1996; Warren 2006
	Turkey	Salda Lake	Basement of partially serpentinized ultramafics (harzburgite, dunite) and dolomites	44	1140	37°33'N	30	NI	[9.0-9.8]	Holocene (?)	Hydromagnesite strandline terraces, including hydromagnesite-cemented fan delta (beach deposits of hydromagnesite containing pebbles of lizardite); stromatolites (coalescent bulbous mounds)	Hydromagnesite; aragonite	Braithwate & Zedef 1996; Russell et al. 1999
	Western US	Pyramid Lake	Basin and Range Province. Volcanic sediments, sialic basement. Aerial inflows and thermal ground waters (10%)	490	1157	40°04'N	NI	NI	9.3	Quaternary	A variety of tufas (dense laminated, branching, palmate, etc.)	Calcite (ikaite?)	Benson 1994
	Tanzania	Tanganyika Lake	Rift System; drainage of the precambrian basement	32,000	770	6°30'S	28.23 (avg.)	13.2	9	[3.3-1.3]	Calcite-cemented ridges of terrigenous sand (beachrocks), ooid sand shoals, and lithified oolite ridges, *Chara* calcareous silts, gastropod shell blankets, and extensive thrombolitic microbial reefs; hydrothermal chimneys	High-Mg calcite; Aragonite	Cohen & Thouin 1987; Casanova & Thouin 1990
	Mexico	Lake Alchichica	Crater lake; tuff ring	2.26	2350	19°24'N	8.7	30.9	8.9	2.8-1.1	Microbialitic domes and crusts	Hydromagnesite; huntite, calcite; Aragonite; Mg calcite	Kazmierczak et al. 2011
	Argentina	Laguna Cari-Laufquen Chica	Volcanic rocks, siliclastic sedimentary rocks locally exposed	4	786	41°9'S	[2-5]	NI	8.7	22	Cauliflower to globular stromatolites	Calcite	Cartwright et al. 2011; Pacton et al. 2016
Hypersaline Lakes	Western US	Great Salt Lake	Tectonically active Basin and Range Province	4.40	1280	41°10'N	[50-263]	[5.4-9.5]	8.6	< 11.5	Strand line aragonitic ooid and peloidal sands (aligned pellets and ooids as parallel flat laminae or thin beds); spring mounds, algal mounds, and stromatolites	Aragonite; calcite; dolomite (early replacement)	Spencer et al. 1981; Halley 1977; Pace et al. 2016; Chagas et al. 2016
	Iran	Lake Urmia	Active strike/slip fault system; Sialic basement, carbonates and piercing salt domes	5.70	1270	37°42'N	[80-280]	NI	7.6	NI	Ooid strandzones; cemented crusts/beachrocks	Radial aragonite	Kelts & Shahrabi 1986; Warren, 1999
Freshwater Lakes	Kyrgyzstan	Lake Son Kul	Central Tien Shan Ranges, inflow by groundwaters	270	3016	41°51'N	Fresh water	NI	NI	[8.87-1.95]	Laminated calcareous muds	Aragonite; Mg-calcite, calcite, dolomite (diagenetic)	Pacton et al. 2015
	Eastern US	Fayetteville Green Lake	Drainage of carbonate rocks	0.26	127	43.05°N	[1.8-2.7]	[3.4-7.1]	NI	< 12	Thrombolitic microbialite; chalks	Calcite	Brunskill et al. 1969; Thompson & Ferris 1990

* Jezero ca 1,500 km2 ** Alkalinity = $[HCO_3^-]+2[CO_3^{--}]$ NI = No information

Table S3: *Summary of microfossils encased in marginal carbonate deposits of terrestrial, recent and ancient lacustrine settings.*

Region	Lake/Basin	Age	Formation	Host facies	Potential microfossil bodies*	Mineralogy (current)	References
Tanzania	Tanganyika	Holocene		Stromatolites	**Filaments** (ca 1µm in diameter)		Casanova & Thouin 1990
Kenya	Bogoria	Holocene		Hydrothermal planar crusts	Acicular crystals encased in **polygonal, alveolar** -0.3 µm in diameter- **networks**	Calcite	Casanova 1990
Tanzania	Natron	Holocene		Stromatolites	Dark, straight tiny -1-10 µm- **filaments** through light-colored laminae; **flabellate filament bushes** encased in clear elongated calcite crystals (1.2-1.5 µm thick filaments)	Filaments preserved as organic streaks or hollow tubes within the crystals	Casanova 1990
Western US	Great Salt Lake	Holocene		Microbialitic crust	Variably segmented **microfilaments** ; micro-enterolithic fabrics of **coccoids** organized in clusters	Secondary aragonite	Vennin et al. 2018
Western US	Searles Lake	Pleistocene		Nodose tufa: cauliflower-like structure with clusters of lobate masses	Adjoining hemispherical, **tubular**, or crenulated **structures**, a few millimeters in diameter; oval -ca 200 µm across- pigmented bodies	Dark-colored lobate layers of banded tufa; calcite	Scholl 1960
Western US	Searles Lake	Pleistocene		Spherulites in tufa towers	Spherulite core (30-150 µm) composed of clumps of **microspheres** (ca 10 µm across) and curved **micro-rods** (200-300 nm in diameter and 1-6 µm in length)	Micrite-microspar surrounded by a cortex made-up of coarse bladed calcite	Chafetz et al. 2018
Western US	Idaho	Cenozoic (Pliocene)	Glenns Ferry Fm	Oolites	Clusters of individual **tubes**, about 4µm in diameter		Swizydczuk et al. 1980
Germany	Ries crater	Cenozoic (Miocene)		Bioherms	Branching **tubes** (180 µm in diameter); millimetric uneven carbonate **tubes** of green alga	Microspar fill & micritic wall	Riding 1979; Arp 1995
New Zealand	Manuherikia	Cenozoic (Miocene)	Manuherikia Gp	Oncoids	**Rounded molds** (ca 80 µm in diameter)	Calcite: microspar fill & micritic wall	Lindvinst 1994
France	Limagne	Cenozoic (Oligocene)		Stromatolites	Variety of erect, branched **filaments**: very small <7 µm in diameter, thin [7 - 25 µm], large -150 µm; Scattered microspheres, 120-170 µm	Sparry and micritic calcite	Bertrand-Sarfati et al. 1994
Western US	San Wash	Cenozoic (Eocene)	Green River Fm	Stromatolitic bioherms	**Micropheres** -ca 100 µm in diameter- *Chlorellopsis coloniata* ; caddisfly larval cases; unveven **shrubby tubes** with peloidal walls	Calcite: microspar fill & micritic walls	Della Porta 2015; Awramik & Buchheim 2014
Brazil	Araripe	Mesozoic (Aptian)	Crato Fm	Domal microbialite	Calcified **honey-comb** structure interpreted as EPS and **spherules** (ca 20 µm) interbedded within the honey-comb structure and interpreted as coccoidal bacterial cells.	Calcite	Warren et al. 2017
Offshore Brazil	Santos	Mesozoic (Aptian)	Pre-Salt Gp	Spherulites	Spherulite core (50-300 µm) composed of a clump of **microspheres** (ca 5-10 µm across)	Micritic	Chafetz et al. 2018
Offshore Angola	Kwanza	Mesozoic (Aptian)	Pre-Salt Gp	Shrubs	Adjoining **microspheres** and **tubes** (200-500 µm) encrusting/capping calcitic shrubs	Calcite	Saller et al. 2016
Argentina	Chubut, Patagonia	Mesozoic (M./L. Jurassic)	Las Chacritas Mb	Tabular stromatolites	Subhorizontal **microfilaments** made up of aligned pores (ca 20 µm in diameter)	Calcite: micritic and microsparitic	Cabaleri et al. 2005
Argentina	San Juan	Late Paleozoic		Thrombolites	**Filament** traces and **calcispheres**	Calcite	Busquets et al. 2007
Australia	Fortescue	Archean	Tumbiana Fm	Stromatolites	Vertically oriented **filament molds**	Calcite	Buick 1992

* original authors' descriptions