

Supplementary Material:

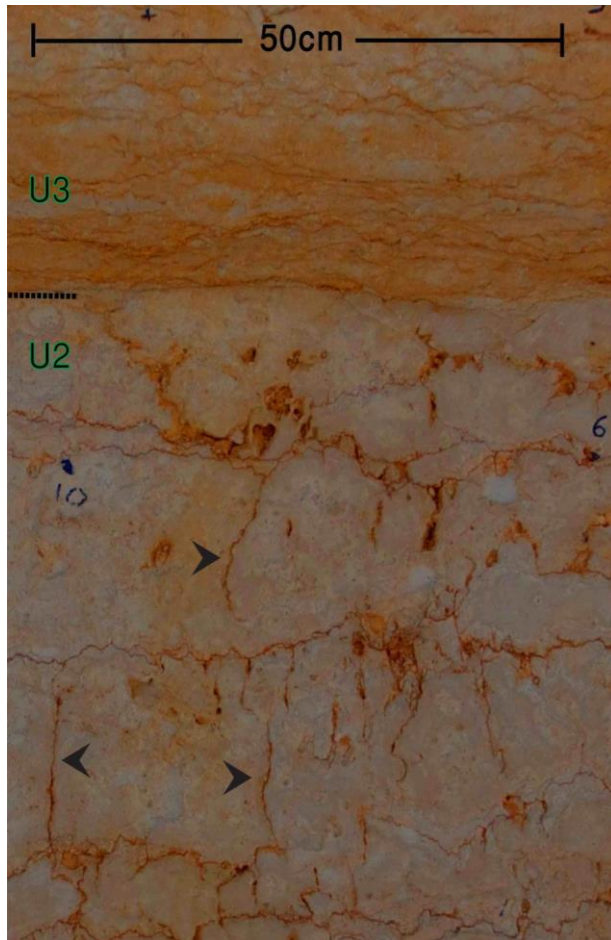
1 **A) Additional field sites of stylolite populations**

2 In this supplementary we introduce other field sites in addition to the three
3 locations, which were described and quantified in the body of the manuscript and in
4 Table 1. Here, sites 4-17 are described. Our classification of stylolite populations to
5 three end-member groups based on connectivity, is founded on all of these locations,
6 some of which were observed and studied by us (sites 1-13), while others are
7 described in the literature (sites 14-17).

8

9 **4. Mitzpe Ramon quarry, other vertical units (N30°38' E34°48')**

10 Detailed study of tens of meters (length) of polished quarry walls in Mitzpe
11 Ramon quarry guided us to divide this exposure of Upper Cenomanian Avnon fm.
12 into five vertical units (from U0 to U4). One of these units (U1) is the one studied
13 statistically and described at length in the manuscript as “Mitzpe Ramon quarry” (site
14 #2). The other four units also contain stylolites and solution seams but each is very
15 different from its neighbors above and below (e.g. Fig I): Units U0 and U3 contain
16 dense regions of pressure solution seams; U2 includes stylolites interconnected with
17 fractures; and the top-most unit, U4, contains anastomosing stylolites, similar to U1.
18 The density of the networks is different between these units. Therefore this quarry
19 presents a case where dissimilar populations occur one above the other in the same
20 geological formation, with abrupt changes between population types.



21

22 **Figure I: Two of the five units studied in Mitzpe Ramon quarry, Southern Israel. U2: a unit with**
23 **an interconnected network of fractures (arrows) and stylolites. U3: a dense network of**
24 **anastomosing pressure solution seams.**

25

26 **5. Nahf quarry (N32°56 E35°19')**

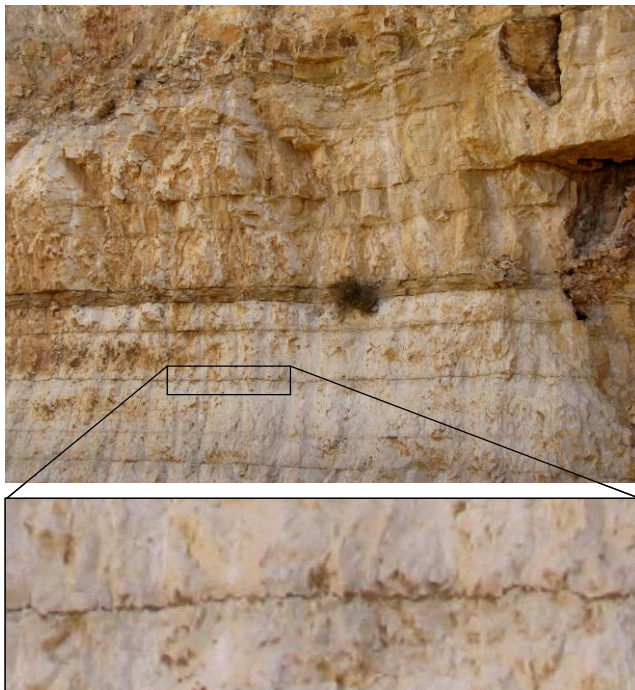
27 The deserted quarry named “Nahf” is located in Northern Israel near a village with
28 the same name. The exposure (~100m in length and ~20m in height, Fig IIa) consists
29 of limestone of the Turonian “Bina” Fm. Bedding-parallel stylolites can be traced for
30 a distance of tens of meters with interconnected networks of smaller-amplitude
31 stylolites in-between them (Fig IIb).

32



34 **Figure IIa: the black lines in the left mark some of the stylolitized surfaces that are continuous**
 35 **for tens of meters.**
 36

37



38

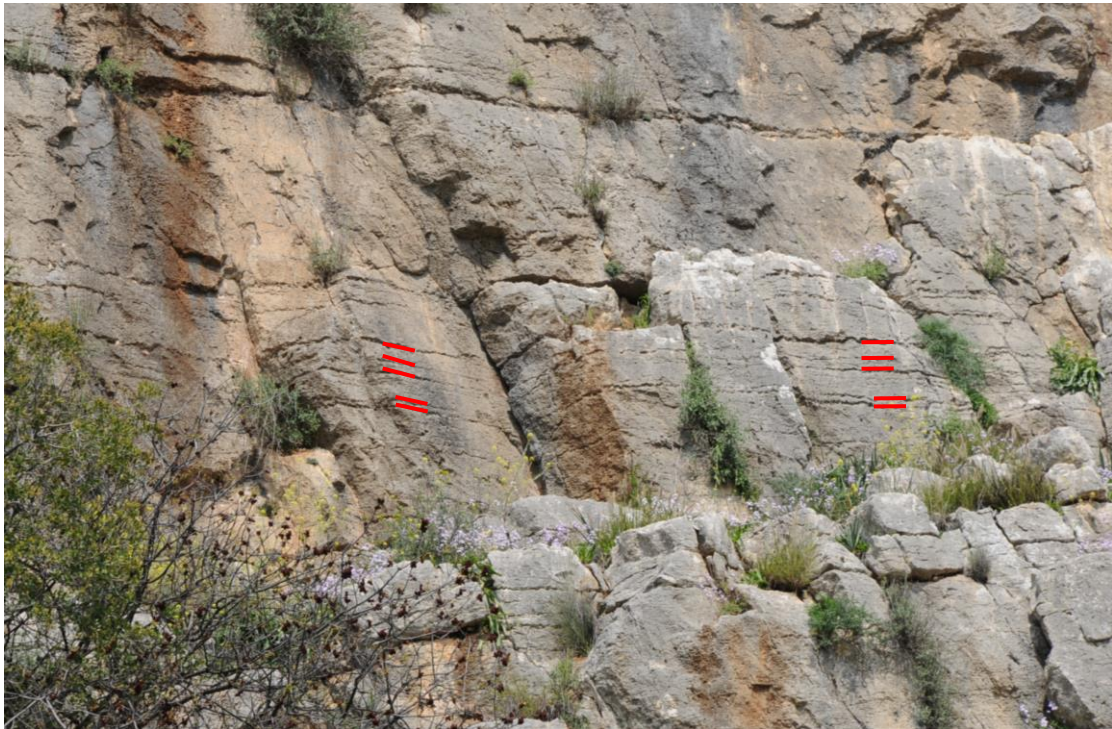
39 **Figure IIb: Closer look at the stylolites in the Nahf quarry. Left: long-parallel stylolites; Right:**
 40 **interconnected network (one of several cores drilled for analysis is seen and is not described in**
 41 **this paper).**

42

43 **6. Ein El-Assad cliff (N32°56' E35°23')**

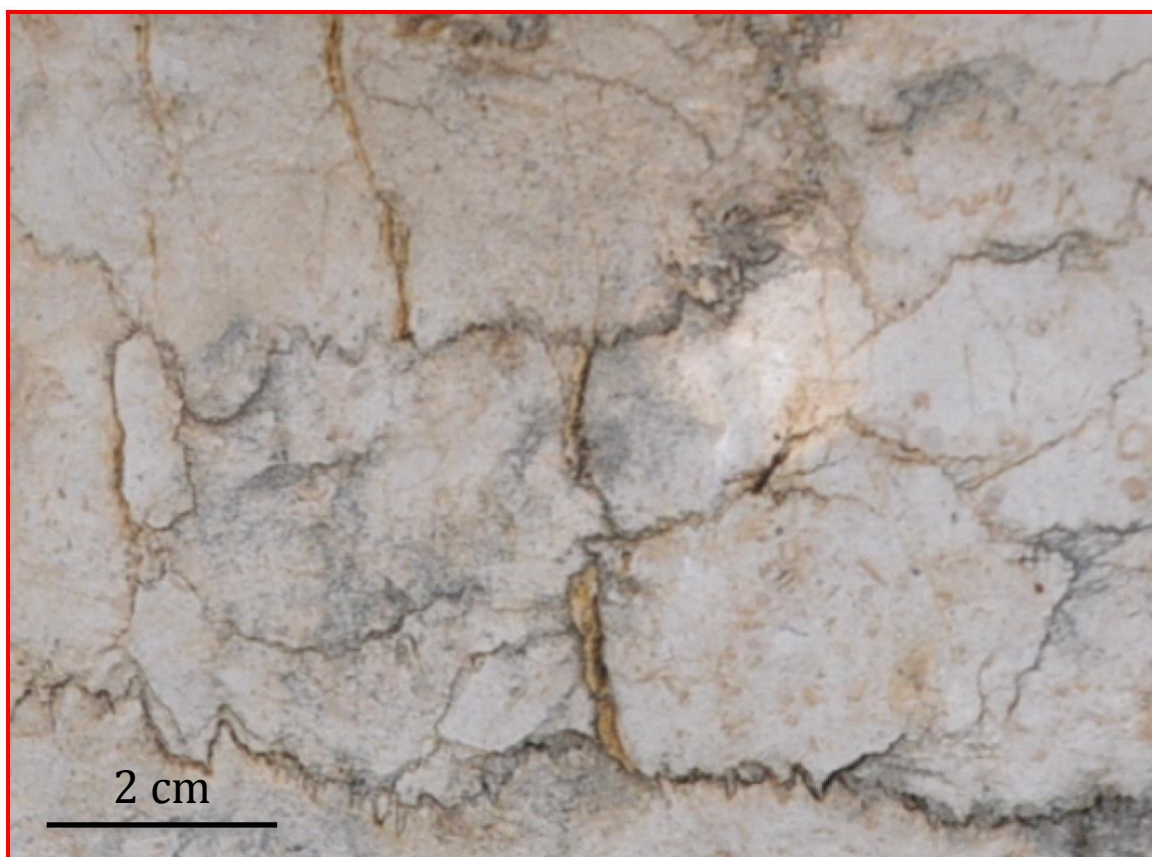
44 This is a naturally exposed biomicritic limestone cliff in which the Albian Ein-
45 El-Assad fm. is exposed (the same formation that was quantified in the Blanche
46 cliff, ~40 km to the north-east, site #1). Long-parallel stylolites with
47 interconnected-networks in-between are exposed in this location. Fig IIIa shows
48 the larger long-parallel stylolites while the network in-between is seen in Fig IIIb.

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51 **Figure IIIa: Long parallel stylolites in the Ein-El Assad cliff (some are marked in red). This is the**
52 **same formation that was quantified in the Blanche cliff (site #1).**



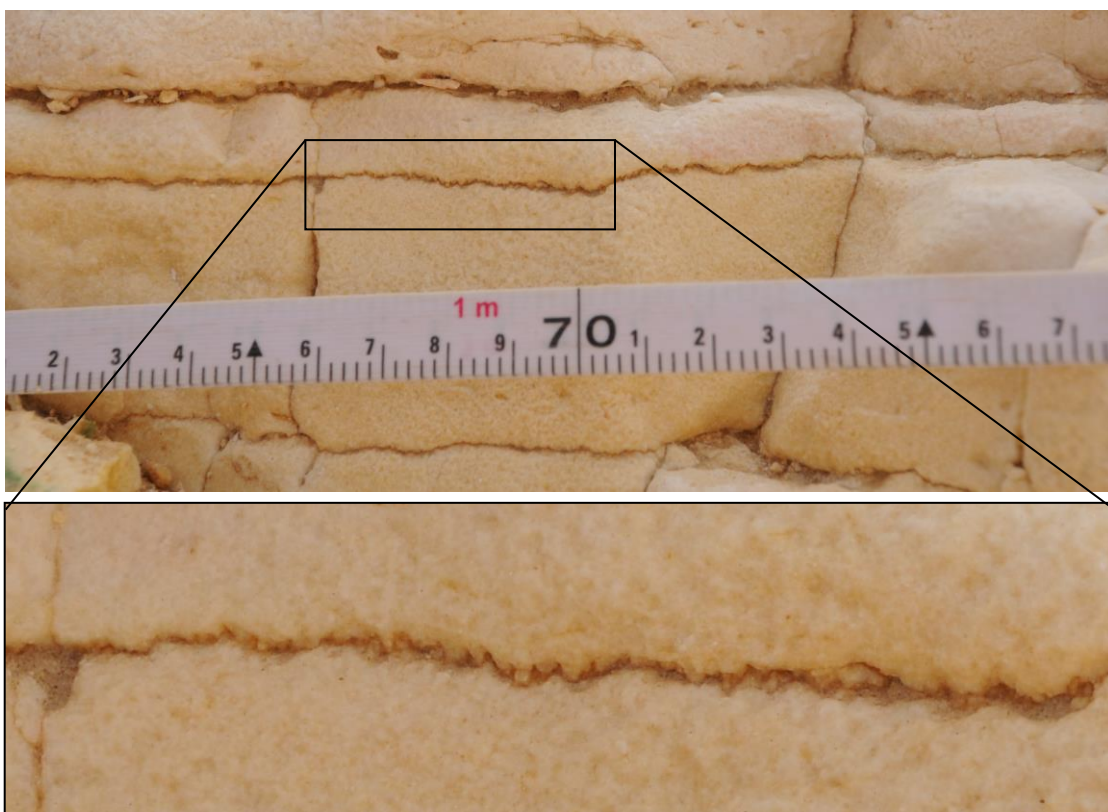
54

55 **Figure IIIb: Interconnected stylolites in-between the long-parallel ones that are seen in Fig IIIa.**

56

57 **7. Tsavoa anticline roadcut (N30°58' E34°46')**

58 This exposure on road no. 40 in southern Israel exposes biomicritic limestone
59 interlayered with dolomite and marl of Nezer fm. (Turonian). Parallel stylolites
60 with mm-scale teeth amplitudes can be traced for several meters (Fig IV). These
61 stylolites are sub-parallel, since at a larger scale (~5m) some of them connect.



62

63 **Figure IV: Sub-parallel stylolites in Tsavoa anticline roadcut. The specific stylolite in the photo**
64 **was sub-parallel to its neighbors above and below for almost 5m.**

65

66 **8. Rama cliff N32°56' E35°21'**

67 An interconnected network of stylolites (Fig V) is exposed in a limestone

68 interlayered with marl Rama fm. (Albian) in northern Israel.



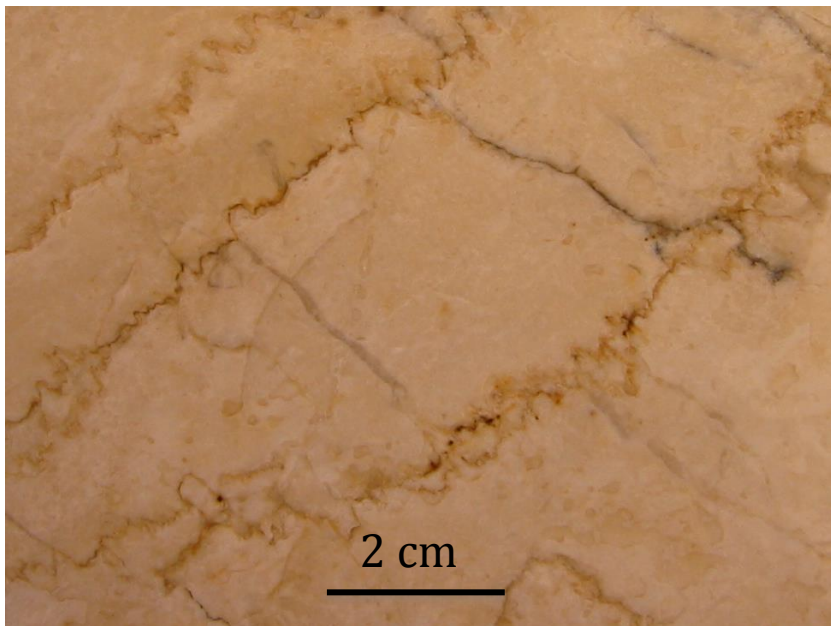
69

70 **Figure V: Interconnected network of stylolites in the limestone-marl Rama fm. in northern**
71 **Israel.**

72

73 **9. Machtsh Katan (N30°57' E35°13')**

74 An interconnected network of stylolites (bedding-parallel as well as tectonic)
75 and fractures is naturally exposed in limestone of Shivta and Nezer formations
76 (Turonian). Many of the fractures emanate from stylolite teeth and are generally
77 parallel to them (Fig VI).



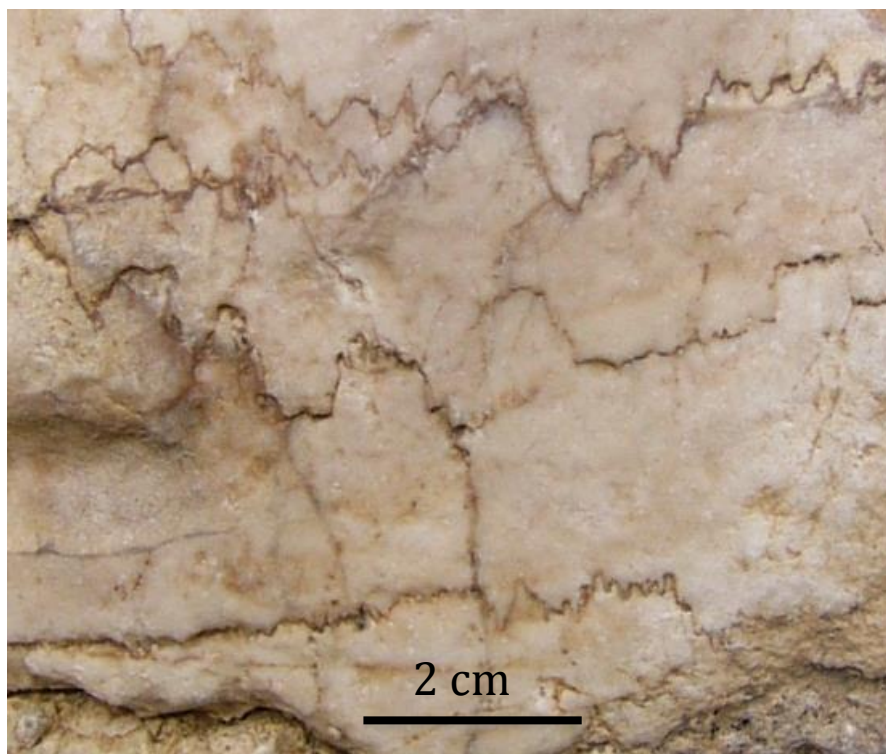
78

79 **FigureVI: Interconnected network of stylolites and fractures in a natural exposure in Machtsh**
80 **Katan, Southern Israel.**

81

82 **10. Maale Yair, Dead Sea (N31°12' E35°21')**

83 An anastomosing stylolite network is developed in limestone of the Turonian
84 Shivta fm. (Fig VII). In this site the network appears in a natural exposure, several
85 meters from a normal fault.



87

88 **Figure IIII: Interconnected network of stylolites near Maale Yair, Dead Sea, Israel.**

89

90 **11. State Collage, Pennsylvania roadcut (N40°47' W77°48')**

91 We traced a single bedding-parallel stylolite with cm-scale teeth amplitude for
92 >100m in a Devonian-Silurian limestone exposure near Route no. 322 near State
93 Collage, Pennsylvania (Fig VIII). Interestingly, this appeared as the only
94 stylolitized surface in this exposure (the bedding surfaces above and below were
95 not rough).



96

97 **Figure IVII: A bedding-parallel long stylolite (marked by the red pen) in a limestone exposure,**
98 **State Collage, Pennsylvania.**
99

100 **12. Morocco**

101 A bunch of constant-spaced stylolites were traced here for ~1km. Some of the
102 stylolites are composite surfaces (seem as composed of several stylolites – as seen
103 below the hammer in Fig IX).



104

105 **Figure IX: Long parallel stylolites in Morocco. Some of these were traced for ~1km.**

106

107 **13. Givat Ram, Jerusalem, building stone**

108 In the university campus amphitheatre in Givat Ram, Jerusalem, Israel, the

109 floor is composed of (probably local) Cenomanian limestone. A composite

110 network of anastomosing stylolites is exposed in these surfaces (Fig X).



111

112 **Figure X: Interconnected network of stylolites in a Cenomanian building-limestone in the**
113 **University Campus in Jerusalem, Israel (coin diameter is 18 mm)**

114

115

116 **14. Flamborough Head, Yorkshire, UK**

117 Stylolites and thicker phyllosilicate-rich seams in a Cretaceous chalk
118 formation exposed along the 6-km southern cliff coast of Flamborough Head
119 (between Sewerby/Bridlington and High Stacks) are described in Safaricz (2002)
120 and Safaricz and Davison (2005) (see fig 3.1 in the former). Some of the stylolites
121 in this site are interconnected while several are described as long and distinct
122 (8.5m longest). They can therefore be categorized as some combination of
123 interconnected network and long-sub-parallel populations.

124

125 **15. Yazd Block quarry, Esfahan Province, Central Iran (N33°27' E54°22')**

126 20 Km south of Khur City in the east of Esfahan Province, stylolites are
127 exposed in an Upper Cretaceous Haftoman Formation quarry for building stone.

128 The stylolites form an interconnected network with fractures (see e.g. Fig 3c and
129 4d in Arzani (2011).

130

131 **16. Illinois Basin Salem Limestone (N38°53' W86°31'; and N38°32' W90°24')**

132 Twelve stratigraphic sections of the Mississippian-aged Salem limestone
133 distributed through the Illinois Basin were studied in the Ph.D. dissertation of
134 Losonsky (1992). Parallel stylolites (with lengths between 7m and 30m) are described
135 in one of these sites (Bedford, In., roadcut, along Indiana State Route 37, near
136 Bedforn, Lawrence County). Many of these stylolites are aligned along particular
137 horizons and some of them grade laterally into zones of dissolution seams. In another
138 site described in this dissertation (St. Louis, Mo., roadcut, along northbound Interstate
139 Highway 270, near I-44 interchange) stylolites are also described as long (up to 20m),
140 but here stylolites are claimed to “form clusters” and en-echelon patterns. This
141 resembles a description of some kind of interconnected network, therefore both
142 networks and long-parallel stylolites are described in this roadcut. The term “isolated
143 stylolite” appears in this reference, although the definition of the term (if it refers to a
144 large vertical distance from neighboring stylolites or to lateral extent) was not clear.

145

146 **17. Selinsgrove Junction, Pennsylvania (N40°47' W76°50')**

147 This site is investigated in the Ph.D. dissertation of Mardon (1988), who
148 conducted multi-scale mapping (from m-scale down to the micro-scale using SEM).
149 Isolated, tectonic solution seams are investigated here, in a fine-grained limestone
150 exposure of the Devonian Selinsgrove Mb., Onandaga Fm. (Devonian). The length of
151 the exposure is ~2m and its height is slightly smaller. This is one of the only detailed
152 field descriptions we found in the literature of isolated solution seams with clear

153 terminations. Some of the solution seams in this outcrop are defined as “composite”,
154 meaning they are not single surfaces, but rather a collection of solution seams, which
155 might be regarded as some kind of interconnected network (i.e. Figures 3 and 8 in this
156 reference).

157
158

159 **B) Calculation of the expected amount of dissolution on a**

160 **Blanche-stylolite using scaling relations observed for isolated**

161 **seams:**

162
163 Isolated solution seams in different locations present a scaling between the
164 amount of dissolved material on the seam, U , to its length, L . According to Nenna and
165 Aydin (2011) the scaling relation on isolated seams follows:

166 (2) $U = 0.013L^{0.7}$

167 while Mardon (1988) measures in a different place a linear relation:

168 (3) $U = 0.006L$

169 Inserting the lateral extent of the outcrop $L= 1\text{km}$ as a conservative estimate for
170 the length of the long-parallel Blanche stylolites, equations 2 and 3 predict that each
171 of the long-parallel stylolite in the Blanche has dissolved $U=1.5$ to 6 meters of rock,
172 respectively. This is in contrast with estimates based on stylolitic teeth height
173 measurements, model simulations, and mass of precipitates of the Blanche stylolites,
174 which suggest 10-30 centimeters of total dissolution occurred on each of the stylolites
175 (Laronne Ben-Itzhak et al., 2012). Thus it is unlikely that growth in the Blanche
176 stylolites occurred via self-similar dissolution and elongation of isolated seams, as in
177 equations 2 or 3.

178 Note that U is correlated to A_{max} but not always identical which is why we
179 differentiated them here.

180

181

182

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