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Phyllosilcates in the Knob Fields around Ariadnes Colles on Mars: Stratigraphy, Mineralogy and Morphology

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The region between Terra Cimmeria and Terra Sirenum contains several fields of enigmatic knobs, in-cluding Ariadnes Colles, Atlantis Chaos and Gorgo-num Chaos. They have been mapped as Hesperian or Amazonian units [1,2] and are located within the shoreline of the Eridania Lake, which might have formed Ma'adim Vallis [3]. The knob fields contain Mg/Fe-rich and locally Al-rich phyllosilicates [5,6, this study]. Following the stratigraphic placement by [1,2], the knobs are younger than the Noachian, in a possible disagreement to [4]. The region also features chloride deposits [7] and valley networks younger than the Hesperian ridged plains (Hr unit [1,2]), named Mid-Latitude Valleys (MLV) by [8], and has been proposed as an MSL landing site by [9].
The knob fields have been mapped by [10] as "surface type 4" of a possible airfall deposit informally named "Electris deposit", which covers the Hesperian ridged plains and cratered uplands. A recent study by [6], suggested that the knob fields are not part of, but postdate the "Electris deposit", yet possibly contain reworked "Electris" material.
Our geological mapping shows that the knob fields are indeed one morphological expression consistent with the "Electris deposit" model [10]. However, the "Electris" deposit does not stratigraphically overlay the Hesperian ridged plains (Hr unit) and is eroded back to the level of the ridged plains, as proposed by [6,10]. Instead, the "Electris" deposit, including the knob fields, is covered or embayed by the ridged plains, and thus is older. This results in a late Noachian age for the "Electris deposit", in agreement with [11]. This also reconciles the apparent contradiction of the stratigraphy suggested by [1,2,6,10] to [4], as the clays would then indeed have formed in the "phyllosian" period, as "sedimentary clays" of [12].
Wide valley networks cut into the "Electris" deposit and may have filled the Eridania lake. The knob fields and clays within are observed at varying total eleva-tions, suggesting separated local basins rather than a single large lake at the time of their formation.
A second generation of valley networks crosscut the light-toned mounds, knobs and patches as well as the ridged plains. They correspond to the MLV described in the Gorgonum and nearby Newton basins [8]. The water locally ponded and formed chlorides. In all knob fields except Gorgonum, the aqueous activities predate the formation of Sirenum Fossae. In the Gorgonum basin, valleys fed a lake [8], which post-dates Sirenum Fossae.

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