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Consequences on humans, lands and climate of the 4-kyr BP impact across the Near East

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The co-occurrence of a sharp dust peak, low lake levels, forest reduction and ice retreat at c.a. 4-kyr BP throughout tropical Africa and West Asia has been widely explained as the effects of an abrupt climate change. Severity and persistence of the drought is assumed to have precipitated the collapse of civilizations in the Aegean world, Mesopotamia, Palestine, Egypt, Indus valley, Central Asia, & China. In contrast, detailed study of soils and archaeological records provided us with evidence to interpret the 4-kyr BP event as an impact, and not as a climate change. Flash heating

and violent turbulence generated by pulverisation at the soil surface of a hot impact melt were suggested by us to have locally damaged habitations, destabilised landscapes and induced soil erosion. In this study, we integrate data of variable quality from archaeological sites and soils of the Near East to refine the regional picture of the 4-Kyr BP impact in terms of age, manifestations, duration, and consequences.

Occurrence of the complete impact-ejecta assemblage within its carbon-vaporized heated surface defines the most intact 4-kyr BP signal, dated at 4050-3950 $\pm$ 50 BP (i.e. 2600-2300 BC, $2\sigma^{14}$C Cal.). Its exact position in well stratified archaeological sequences just before the early Akkadian phase (at the end of EDIII or EBIII) dismantles a correlation with the collapse of the Akkad Empire. Coherence of the 4-kyr BP record within carefully maintained living floors in sites from distant regions certifies the continuity of occupation after the event. Damage to habitations, occupants and lands by surface heating and selective melting at temperature around 700-1000˚C vary strongly at local scales, and seem to have rarely lead to irreversible destruction. High energy dust mobilisation originated from deflation of the fragilised soils subsequently to the hot-ejecta shower identifies effects of an impact-related air blast throughout lands and habitations. The soil record of high-energy runoff and structural collapse indicates recurrent heavy rain showers for the following months. The rainfall anomaly would reflect changes of atmospheric chemistry in response to injection of carbon-rich aerosols. This trend is also supported by evidence for acidification of rainwater as expressed by carbonate depletion. Evidence in gently undulating flood plain of rapid silting by low energy runoff and recurrent windstorms along with progressive stabilisation of soils during the following years suggest persistence of climate instabilities during re-establishment of the pre-event conditions. In contrast, regions sensitive to soil erodibility suffered irreversible soil loss and never restored the pre-event geomorphological conditions. Regional variability of the indirect consequences of the 4-kyr BP impact on landscapes illustrates how a suite of processes triggered by a large-scale phenomena evolves through time at its own rhythm depending upon local factors. Restoration of the pre-event climate within about hundred years, and stability for the following centuries refute the role of climate on collapse of the Akkadian Empire 150 years after the impact; collapse for another reason must be invoked.