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Lake Magadi is a saline pan in the southern Kenya Rift Valley that has become the most important modern/Pleistocene analog for alkaline saline lake deposits. The modern surface is normally dry except when surface flooding turns the pan into a shallow lake. Nasikie Engida is a small perennial alkaline lake separated from Lake Magadi. The Magadi Basin is fed by ephemeral stream runoff and alkaline springs but springs are the dominant solute contributor. Hot spring inflow reaches temperatures > 80 ⁰C and pH of 9.4; it is enriched in Na+, HCO3-, CO32-, and Cl-. The combination of arid climate, closed basin hydrology, rifting and magmatic activity, hydrothermal spring inflow, and alkaline surface brines with pH up to 10.6, and HCO3- + CO32- concentrations up to 105,000 ppm, have created ideal conditions for the formation of chemical sediments.

Study of modern chemical sediments in the Magadi Basin and Pleistocene deposits up to ~1 million years old (up to 197 m deep) recovered in cores to bedrock by the Hominin Sites and Paleolakes Drilling Project (HSPDP) has expanded our understanding of sedimentary and diagenetic processes in alkaline saline lakes. Evaporite minerals including trona (NaHCO3.Na2CO3.2H2O) and nahcolite (NaHCO3) occur in the modern basin and at depths exceeding 60 m. Siliceous gels form along the shoreline of Nasikie Engida; diagenesis of gels has produced newly discovered “labyrinth structures” in subsurface cherts. Other chemical sediments in the HSPDP cores include: laminated magadiite composed of lepispheres; “Magadi-type cherts” that have replaced evaporites, magadiite, gels, diatoms, carbonate fossils (ostracodes and gastropods), and silicified plant fragments with perfect structural preservation; zeolite (most commonly erionite and analcime) replacement of volcanic glass; cements, displacive crystals and nodules composed of Mg-calcite; and diagenetic pyrite crystals. The HSPDP cores confirm a profound shift from an early shallow dilute lake evolving to a narrow, at times anoxic, stratified, saline lake with volcanogenic sediments (now zeolite), chert, and finally evaporites.