Changes in coated grain-types from travertine to tufa deposits in Azuaje carbonate building (Canary Islands, Spain)

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Varied types of coated grains have been found in perched and fluviatile travertines and tufas along 3 km of Azuaje Ravine in the volcanic island of Gran Canaria (Canary Islands, Spain). The systems show a clear evolution from travertine to tufas along the Ravine. Coated grains have been grouped into ooids and oncoids based exclusively on their characteristics

Ooids show regular concentric smooth envelopes and 0.1 mm-2 mm in size. Three main types of cortex have been distinguished: (i) radial fibre or acicular crystals comprising the whole cortex diameter and crosscutting the lamination, (ii) banded-radial arrangements with alternating layers of radial fibres and micritic layers, and (iii) micritic. Nuclei are intraclasts, peloids, spherulites, small plant part moulds, or may absent by dissolution, or undistinguishable from the cortex. Ooids are commonly spherical to ellipsoidal. Frequently two or more individual coated grains agglutinate and form compound grains. Mineralogy varies between aragonite and aragonite-calcite.

Oncoids are 0.4 mm to several millimetres and exceptionally tens of centimetres (nuclei of palm tree leaf moulds). They display two main types of coatings: (i) thin, irregular, dense micritic laminae, and (ii) generally thicker porous laminae usually made of dendritic, shrubby, or columnar (branched) crystal aggregates, containing alternating lamination. Lamination is slightly wavy to mammillated. Nuclei are similar to those of the ooids, being intraclasts and plant moulds (leaving moldic porosity) the most common. Shapes are varied and generally irregular depending strongly on the shape of nuclei. Mineralogy varies from aragonite, to aragonite-calcite mixtures, and to exclusively calcite in tufa.

Diagenetic changes are widespread, being apparently more intense in travertine than in tufa facies: aggrading recrystallization, aragonite inversion, dissolution, and cementation are the most common processes.

$\delta^{13}C$-$\delta^{18}O$ plots from each individual deposit show positive covariant trends. Isotope signals of coated grains are indistinguishable from other of the same deposit. $\delta^{13}C$ decreases as the amount of calcite increases which suggest: a) that primary aragonite facies are heavier in carbon than those composed of calcite, and ii) diagenetic transformations deviate the primary signals to heavier ^{13}C values.

Ooids are restricted to travertines. Oncoids are ubiquitous, but changing strongly their features in downstream direction. Tufa deposits placed downstream only content oncoids with intraclasts and large plant moulds as nucleus, as well as thicker and more irregular coatings, than those found in upstream travertines.

Coated grains formed with low to no displacement, as is suggested by their high diversity and the uncommon occurrence of deposits with mixed grains. Scarcity of detrital clasts as nuclei of coated grains suggests low clastic input from upstream but also from ravine walls. These may be related to slope stability, but also with the absence or attenuation of floods.

Restricted distribution of ooids, sharp changes in oncoid type, mineralogy, isotopes and diagenesis suggest an abrupt change downstream in environmental conditions reflected in changes in vegetation and $CaCO_3$ precipitation rates and mineralogy.

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