Tracking the provenance – Assessing sedimentary pathways and upper plate dynamics at the South Central Chile margin

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A combination of apatite fission track (FT) dating and sediment analysis was carried out on modern to subrecent trench sands from gravity cores and estuarine sands of South Central Chile between 46˚ and 30˚S to (a) obtain information on sediment provenance, present-day erosion patterns, tectonic processes in the source area and (b) to test the generally made assumption of a negligible transport time within the lag time concept.

Bulk samples were collected from major rivers with drainage systems encompassing the three main Chilean morphological units, i.e. the Main Andean Range, the Longitudinal Valley the Coastal Cordillera. Between 36˚ and 42˚S the fluvial load of rivers such as e.g. the Biobío is transported via submarine canyons to large trench fans. These sites were preferentially targeted for gravity coring as they are not or only subordinately subject to the northward directed material transport within the trench, and thus are supposed to reflect the source area.

Apatite FT age distributions from the trench fans and the estuaries were tentatively referred to their sources by comparing their single grain age distribution to the cooling age pattern of the bedrocks of the feeder area. Drainage systems were derived from digital elevation models, and areal extents of units carrying a specific age signature were quantified. Thus we could denominate those units contributing to the flux of sediment to the basin, which seem to be over- or underrepresented in the river-mouth resp. trench fan sediment.

Sedimentological and mineralogical investigations suggest an overwhelming volcanic contribution from the Main Cordillera. Indeed, a pronounced signal of Late Miocene ages, most likely of volcanic origin, occurs within most FT grain age distributions. However, an older, Cretaceous, population significantly contributes to the detrital grain age distributions. Within the Biobío drainage, e.g., Cretaceous age groups, con-

sistent with ages from the Coastal Cordillera, account for most (>80%) of the total population of dated grains. This implies that a large portion of the apatites was shed off the Coastal Cordillera despite a low relative fraction (<20%) of the total drainage area. In contrast, young apatites from the easily erodible volcanic edifices in the Main Range only subordinately provide apatite to the trench. Although first-order controlling parameters such as apatite content and erosion rates play a major role, the repeated dominance of the Cretaceous signal is probably triggered by very recent uplift of this coastal segment. This uplift, however, is not yet reflected in the FT ages as erosion has not yet reached the depth of the apatite FT partial annealing zone in the Coastal Cordillera. Our data also show that the generally held assumption of zero transport time in plate margin depositional systems is valid. In the specific case of South Central Chile this means that there is direct and straightforward sediment transport, bypassing the continental slope.