Provenance of northwestern Patagonian river sediments (44-48 degrees S): A critical evaluation of mineralogical, geochemical and isotopic tracers

Por: Liu, DW (Liu, Dawei)[1]; Bertrand, S (Bertrand, Sebastien)[1]; Villasenor, T (Villasenor, Tania)[2,3,4]; Van Dijck, T (Van Dijck, Toon)[1]; Fagel, N (Fagel, Nathalie)[5]; Mattielli, N (Mattielli, Nadine)[6]

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Abstract

The ability to trace and quantify sediment provenance in northwestern Patagonia is increasingly needed to properly understand modem sediment erosion and transport processes in this rapidly changing environment, and to accurately interpret sediment records from adjacent basins in terms of climate and environmental change. Nonetheless, no study so far has systematically evaluated the effectiveness of different tracers to reconstruct sediment provenance in this region. To fill this gap, we assess the effectiveness of commonly-used provenance indicators, including bulk mineralogy, major and rare earth element (REE) geochemistry, and Sr and Nd isotopes, to reconstruct sediment provenance in northwestern Patagonia. First, the ability of these tracers to discriminate between the main sources of sediment in the region is investigated, mostly using data compiled from the literature. Then, the potential of these tracers for provenance reconstruction is assessed by comparing the composition of sediments from six major Chilean rivers between 44 and 48 degrees S to lithological proportions in their respective watersheds. The results suggest that mineralogy, major element geochemistry, and REE geochemistry can be used as qualitative tracers of sediment provenance. However, the compositional overlap between the sources and the relatively large variability within them prevent quantitative reconstructions. By comparison, Sr-87/Sr-86 and epsilon Nd allow to clearly differentiate between the sources, most likely due to significant age differences between the main lithologies, and to estimate the relative contribution of each source. End-member mixing results based on Sr and Nd isotopes show that the relative source contributions are in general agreement with the lithological proportions in the river watersheds. Differences between estimated contributions and lithological proportions in the watersheds are interpreted as the result of the high regional precipitation gradient and unequal glacier distribution, which lead to variable erosion rates across the study area. Our results demonstrate the suitability of Sr-87/Sr-86 and epsilon Nd for quantitative provenance reconstruction in northwestern Patagonia. They constitute a strong basis for the interpretation of sediment archives from the Patagonian fjords and from

the eastern South Pacific, and they should be particularly useful to quantitatively investigate modern and past earth-surface processes.

Palabras clave

Palabras clave de autor: Sediment provenance; Chilean Patagonia; Sr isotopes; Nd isotopes; Mineralogy; Inorganic geochemistry
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Información del autor

Dirección para petición de copias:
Ghent University Univ Ghent, Renard Ctr Marine Geol, Krijgslaan 281 S8, B-9000 Ghent, Belgium.
Dirección correspondiente: Liu, DW (autor correspondiente)

+ Univ Ghent, Renard Ctr Marine Geol, Krijgslaan 281 S8, B-9000 Ghent, Belgium.

Direcciones:

+ [1] Univ Ghent, Renard Ctr Marine Geol, Krijgslaan 281 S8, B-9000 Ghent, Belgium
+ [2] Univ Chile, Dept Geol, Plaza Ercilla 803, Santiago, Region Metropol, Chile
+ [3] Univ OHiggins, Inst Engn Sci, Rancagua, Chile
+ [4] Univ Chile, Millennium Nucleus Paleoclimate, Santiago, Chile
+ [5] Univ Liege, Lab AGEs, Quartier Agora,14 Allee 6 Aout, B-4000 Liege, Belgium
+ [6] Univ Libre Bruxelles, Lab G Time, 50 Ave FD Roosevelt, B-1050 Brussels, Belgium

Direcciones de correo electrónico:dawei.liu@ugent.be

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