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Heavy mineral sorting process: the example from Grande beach (Sintra, Portugal)

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INTRODUCTION

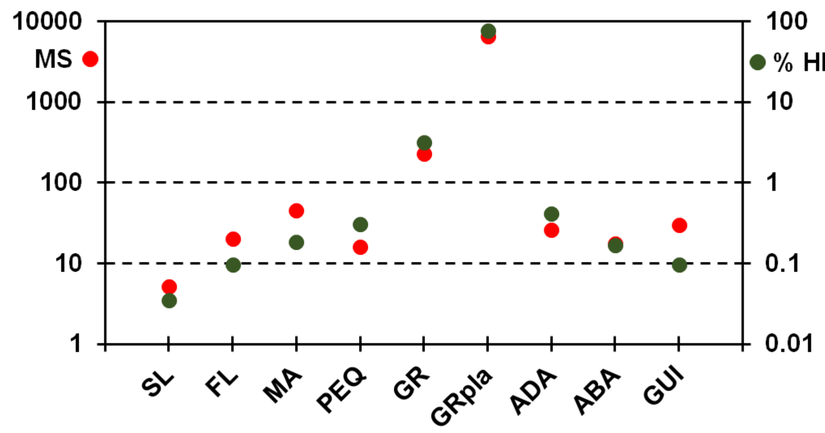
Grande beach stands out from the rest of nearby beaches due to the striking abundance of blackish sand that makes up a heavy mineral placer (Figs. **C** and **D**).

OBJECTIVE

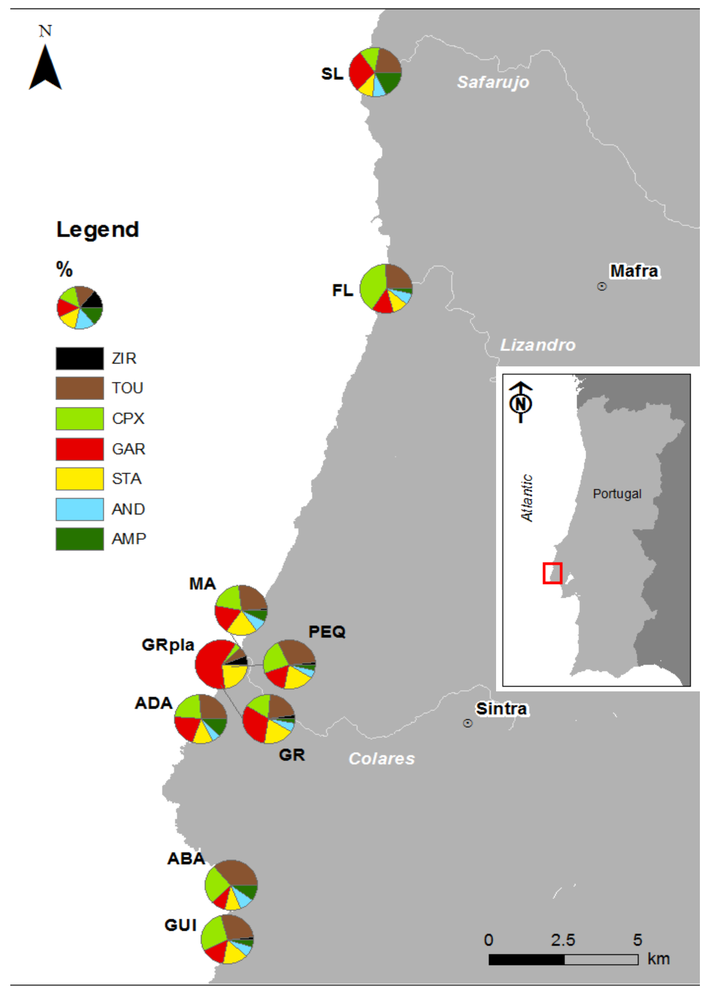
This study aims to understand the process leading to the accumulation of the blackish sand through the interpretation and comparison of the mineralogical composition of Grande beach and nearby beaches (São Lourenço, Foz do Lizandro, Maçãs, Pequena, Adraga, Abano and Guincho).

METHODS

- Measurement of magnetic susceptibly;
- X ray diffraction (Grpla sample);
- Optical identification of transparent heavy minerals.



Magnetic suscptibility (MS) and heavy mineral concentration (% HM)



RESULTS

- Magnetic susceptibility (MS): from **5** (SL sample) to **6500** (Grpla sample);
- Heavy mineral concentration (%HM): from **0.03 %** (SL) to **76.64 %** (Grpla sample);
- X ray diffraction analysis (Grpla sample): **ilmenite (IL - 36 %), magnetite (MAG - 29 %), hematite (HEM - 11 %), garnet (GAR - 8 %)** and **zircon (ZIR - 6 %)**;
- The prevailing transparent heavy mineral assemblage: **TOU, CPX, GAR, STA, AMP, AND** and **ZIR**;
- In Grpla sample: **GAR, STA** and **ZIR**, as transparent minerals and **IL, MAG** and **HEM**, as opaque minerals.

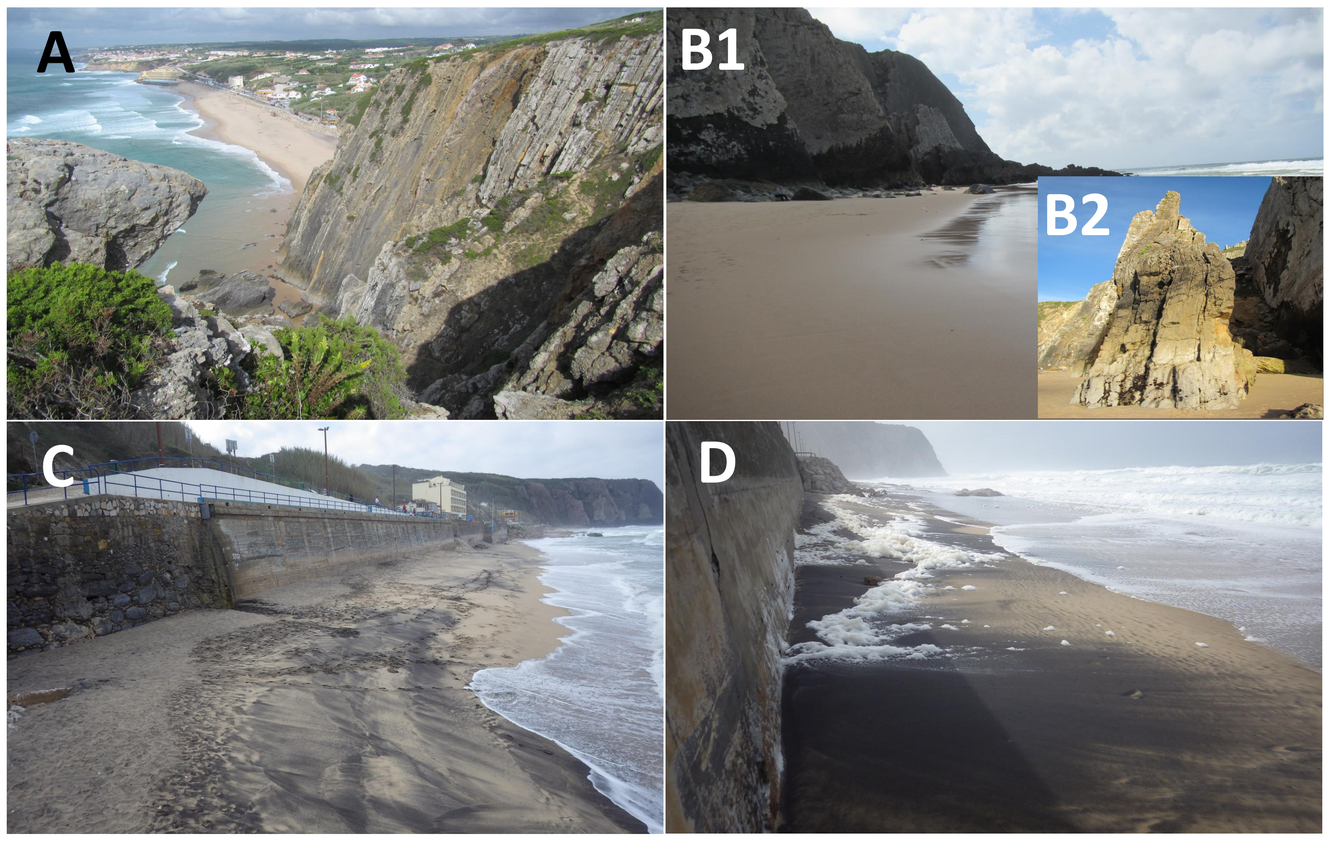
DISCUSSION AND CONCLUSIONS

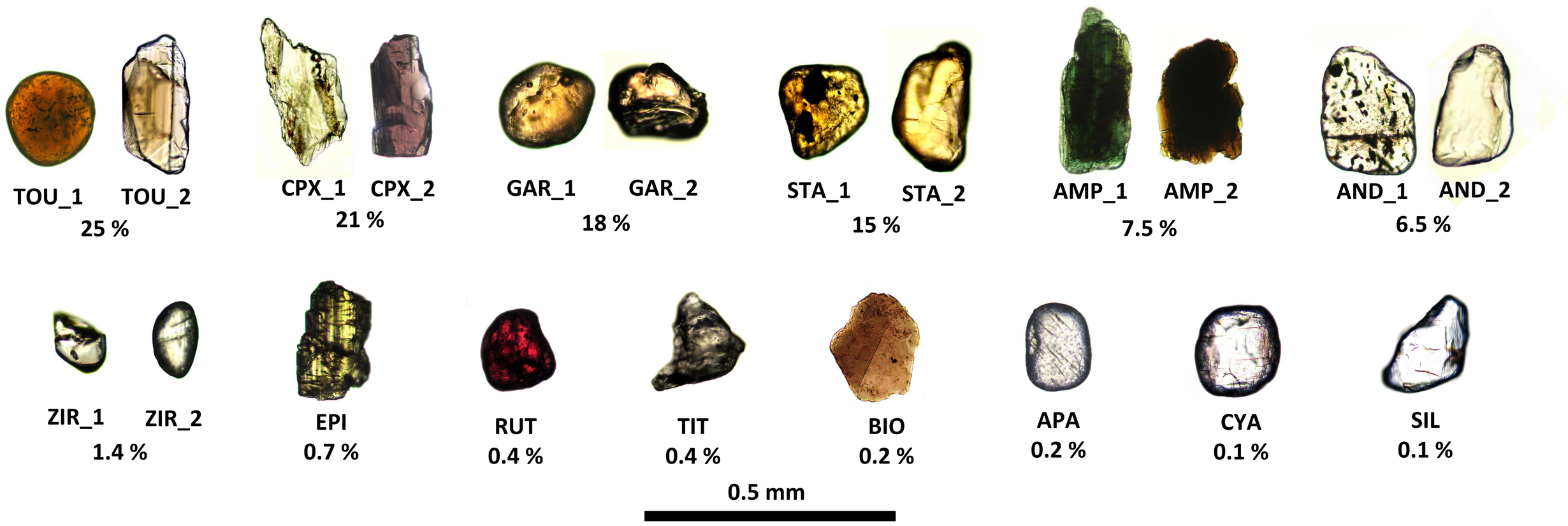
The heavy mineral placer is characterized by an opaque suite composed by **IL, MAG** and **HEM** and a transparent suite dominated by **GAR, STA** and **ZIR.**

The presence of a rock promontory with remarkable dimensions (“Calhau do Corvo”) at Grande beach acts as a natural barrier to the downdrift sand transport (Figs. **A, B1** and **B2**).

Grande beach acts as a “filter” for the sediments that are transported by littoral drift promoting the heavy mineral concentration by the selective bypassing of the light minerals (Fig. **C**).

When major storms occur they boost the effect of this selective process, leading the formation of sand deposits that are very rich on heavy minerals (**heavy mineral placer –** Fig. **D**).





Visual aspects of the transparent heavy minerals: **TOU_1 and 2 – tourmaline; CPX_1 – clinopyroxene (diopside or augite); CPX_2 – clinopyroxene (titanaugite); GAR_1 and 2 – garnet; STA_1 and 2 – staurolite; AMP_1 – green hornblende; AMP_2 – brown hornblende; AND_1 and 2 – andalusite; ZIR_1 and 2 – zircon; EPI – epidote; RUT – rutile; TIT – titanite; BIO – biotite; APA – apatite; CYA – cyanite; SIL – silimanite.** Values in percentage represent the average frequency of the minerals in respect to the total transparent suite. Images captured with a **Nikon Optiphot – Pol** and a **Leitz Wetzlar** petrographic microscopes under plane polarized light using a **Nikon D70s (6 MP)** and a **Canon D10 (12 MP)** cameras.