

In defense of stamp collecting: the importance of case studies for Geology teaching

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Introduction

The expression “stamp collecting” is commonly used in a derogatory way for study areas that frequently rely on case studies and observations, sometimes resulting of chance, which can be perceived as akin to a mere accumulation of facts without value for theories or as being only usable in an inductive perspective.

However, even the main opponent of inductivism of the last century, Karl Popper, admitted that “some [scientists] may get their ideas by observing, or by repeating observations” (albeit this was put at the same level of getting ideas from smoking or drinking coffee or whisky).

In Geosciences there is a long history of the relevance of case observations that can serve to refute models or as catalyzers of ideas, namely for features that cannot be replicated under controlled experimental conditions.

The present work aims to present an overview of examples illustrating how case observations can contribute to Geology teaching, based in the author's own experience concerning both rock outcrops and stones present in the built environment. The examples presented will concern diverse study areas namely Mineralogy, Geomorphology, Geochemistry, Petrology, Ore deposits, Engineering Geology and Mineral Exploration.

Cases (stamps) organization

The first issue for the preparation of this communication concerns the organization of the illustrative cases (stamps) considered. One possible option will be to organize them by concepts or subjects. However, each of the cases presented here can serve to discuss diverse subjects and issues.

My researching experience perhaps biased me to organize the stamps in a perspective related to the anthropogenic influence: outcrops, anthropogenic rock-cuts, built structures and anthropogenic analogues (these categories will be explained in the following sections).

Outcrops

The term outcrop will be used in what I believe to be its classical meaning: portions of geological objects in expositions that are not the result of human action. These are the classical founding objects of Geology and the large majority of Geological studies are based on them (even if this has been somehow changing). The perspective here is to look and collect the highest amounts of stamps and there are recommendations on field recognition that amount to a kind of stamp collecting rules.



Stamp of typical boulder weathering of granitic massifs.
Discuss hazards related to rock boulders movement
Discuss the potential advantage of these processes to obtain stones suitable for structure building with minimal processing.

Anthropogenic rock-cuts

This category corresponds to surfaces cut in rock masses by human action (roads, quarries and mines). They offer fresh stamps in directions and depths that are frequently unavailable in outcrops.

Besides more traditional geological observations, anthropogenic rock cuts frequently also allow the observation of the implementation of procedures to deal with geological hazards, namely in relation to mass movements.

Geological structures (bedding, rock joints families), weathering degree of rock masses and their products (which can be related to the development of mineral deposits)





Presence of rock boulders within saprolite zones (relevant for discussions of geotechnical survey), characteristics of rock masses with relevance for geotechnical classifications, including joint length and joint walls coating (which can be related to mineralogical concepts), conditions for rock failure and intervention to minimize these hazards (metallic net).

Built structures

While the previous categories concerned exclusively the local (in fact in loco) geological products, this category, and the next one, can offer exotic stamps from faraway lands and processes that are absent in the human-free geological local context (what Hazen et al. refer as anthropogenic xenoliths).

Stamp of granite stones similar to the local rock are juxtaposed to stones of very exotic rocks that, furthermore, serve to illustrate structural features.



Another exotic
stone (marble
stone in a
granite region)
where
additionally
one can see
planar
structures
illustrating the
apparent
variation of
dip according
to plane of
view



Pegmatite
veinlet
discordant on
the granite
with
tourmaline
crystals
(which can
also be useful
to discuss the
concentration
of
incompatible
elements on
pegmatites)



Some built structures stamps can also suggest implicitly interesting features of rock masses: the stamp shows a façade with slightly yellowed (weathered) granite but perhaps the most striking feature will be the very big monolithic columns, which will have required blocks of great size.



Anthropogenic analogues

This section comprises cases that are related to anthropogenic action and that might be not considered "geological" from a more traditional point of view but that nonetheless can be used to illustrate geological processes and products.

All the cases considered are unintended consequences of anthropogenic action, unintentional being a critical issue in the delimitation discussed in Alves (2017).

Stains related to sulphide oxidation (mineral exploration and impact of mine wastes).

Serves to discuss some limitations of stamps in general: in some cases the stain is contained within a single stone (stain presented before stone emplacement or developed afterwards?) while in others the stain crosses limits between stones (Principle of Intersection).



Effects of erosion along structural features (stratification) as well as illustrating the relationship between substrate characteristics and the start of biological colonization



Travertine or tufa forming in stair steps of the built environment



Also highlights issues with anthropogenic analogues: origin of these crusts presents clear genetic differences in relation to the classical carbonate deposits (but these differences can also be helpful in a teaching perspectives, for this stamp the issue of carbon sequestration).

Conclusions

The cases (stamps) presented here, from traditional outcrops to unintended anthropogenic analogues that might be frowned upon from a more traditional geological perspective, serve to show diverse potential situations related to observations that will be useful to teach geological concepts associated with processes and products (highlighting also limitations related to scale effects and specific features of the anthropogenic analogues).

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