SAND LANDSCAPES IN AUSTRIA – AN INTERDISCIPLINARY COLLECTION OF NATURAL AGGREGATES FOR THE CONSERVATION PRACTICE*

HOMOKTÁJAK AUSZTRIÁBAN – RESTAURÁTORI FELHASZNÁLÁSRA SZÁNT TERMÉSZETES ADALÉKOK INTERDISZCIPLINÁRIS GYŰJTEMÉNYE

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Abstract

Conservation practice has shown that ready-mix mortars rarely provide an optimal solution for the reconstruction of historical architectural surfaces. On the other hand the use of self-made mixtures of binder and aggregate does not only require the appropriate know-how and experience, but also the use of suitable materials, among others the right sand. In the frame of a 3-year sampling campaign a total of 134 sand pits, natural sand occurrences and stone quarries were sampled all over in Austria. Properties such as grain size distribution and mineralogy were determined for each sediment sample. More than half of the samples (72) belong to recent or paleofluvial sands, 43 was classified as colluvial sediment and the rest belong to the groups of marine (7), glaciofluvial (4) and crushed (8) aggregates. Petrographic characteristics and grain size distributions correspond well with the geological-sedimentological origin of the materials. Depending on their properties the selected and indexed aggregates may be suitable for a wide range of applications in conservation and restoration of historic façades and other cultural assets. Comprehensive information on all aggregates is collected in a database and published online.

Kivonat

A restaurálási gyakorlat számos alkalommal bizonyította, hogy a kész vagy zsákos habarcsok ritkán alkalmasak történeti homlokzatok sikeres helyreállítására. Másrészről azonban a saját készítésű kötőanyag-adalékanyag keverékek használata nem csak a szükséges tudást, de a megfelelő anyagokat, többek között az alkalmas homok használatát is megköveteli. Egy 3 évig tartó projekt során Ausztria teljes területére kiterjesztve 134 homokbányát, természetes homok-előfordulást és kőbányát mintáztunk meg és az egyes üledékmintákat szemcseméret-eloszlásuk, ásványtani összetételük alapján vizsgáltuk és jellemeztük. A minták több mint fele (72 db) folyóvízi eredetű, 43 minta kolluvialis eredetű üledék, a maradék anyagok tengeri (7 db), glaciofluviális (4db) üledékek, ill. kőbányákból származó (8) zúzott adalék. A petrográfiai és szemcseméret-eloszlási jellemzők jól tükrözik a minták geológiai-szedimentológiai eredetét. A fenti jellemzők alapján megállapítható, hogy a vizsgált üledékek széles körben alkalmazhatók adalékként történeti felületek és egyéb kulturális értékek restaurálása-konzerválása során. Az üledéktípusok átfogó jellemzőit egy online adatbázisban bocsátjuk az érdeklődő szakemberek rendelkezésére.

KEYWORDS: SANDY AGGREGATES, SAND LANDSCAPE, PETROGRAPHY, GRAIN SIZE DISTRIBUTION, DATABASE

KULCSSZAVAK: HOMOKOS ADALÉKOK, HOMOKTÁJ, PETROGRÁFIA, SZEMCSEMÉRET-ELOSZLÁS, ADATBÁZIS

Introduction

Besides binder, sand is the most important component of historical and modern mortar systems.

Sandy aggregates were regionally used materials in traditional architecture and only the expansion of traffic routes as well as decreasing transport costs made possible the nationwide distribution of specific aggregates from the second half of the 19th century (Huber et al. 2018). Today, aggregates are predominantly quarried in large sand pits or crushed in stone quarries and mostly used in ready-mix mortars as well as transported to construction sites far from the excavation areas.

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In addition to the appearance of a traditional render surface, the sand applied is also assertive for the technical properties of hardened mortar. Thus, the mortar used for the conservation of a historic façade should be compatible, as far as possible, in terms of physical, chemical and mechanical properties, but also in structure and color to its historical counterpart (Rosário Veiga et al. 2001, Schueremans et al. 2011). Hence, to obtain an authentic and technologically suitable conservation, the use of regional sands in mortar mixes is of outmost importance.

Similarly to natural stones which often determined the appearance of masonries in a certain region, the sand used at the construction work also influenced the color and structure of render surfaces reflecting the local geological-sedimentological characteristics. Therefore, the architecture followed in its materiality the feature of the landscape and was thus a part of it; a part of the so-called sand landscape (Huber et al. 2018).

Today, the selection of suitable aggregates to produce mortars for conservation purposes often generates difficulties in preservation of traditional architectural surfaces, caused predominantly by the uniformity of commercially available aggregates. Therefore, in 2014 the Federal Monuments Authority Austria started an extensive research and sampling in each of the Austrian Federal Lands aiming at establishing a collection and database of natural aggregates for conservation purposes. Based on previous researches (Hassler et al. 2011, Zötzl et al. 2013) as well as economical and practical considerations (BMWFJ 2012) the project is not aimed at dealing with the exact geological-sedimentological characterization and all-over sampling of all possible and available sand occurrences in the country, but focuses on a comprehensive collection of either commercially available and/or historically significant aggregates for conservation purposes. Hence, the database serves as a basis for finding suitable sands for conservation in order to substitute the standard industrial products available on the market.

Sampling and methods

As an example, a typical sand landscape in Austria is formed by the bright sand of the lower reaches of the Salzach River; the traditional building sand of many historic monuments in Salzburg (Huber et al. 2018). Nevertheless, since more than 60% of Austria's territory is mountainous, exhibiting complex geological build-ups and geomorphological development (**Fig. 1.**), even smaller areas may have high diversity of different types of sediment. These complex conditions in many regions limit the possibility of determining unambiguously a historical sand landscape. In these cases the selection of sediment deposits was primary based on the geological and geomorphological characteristics (Oberhauser 1980, Tollmann 1980).

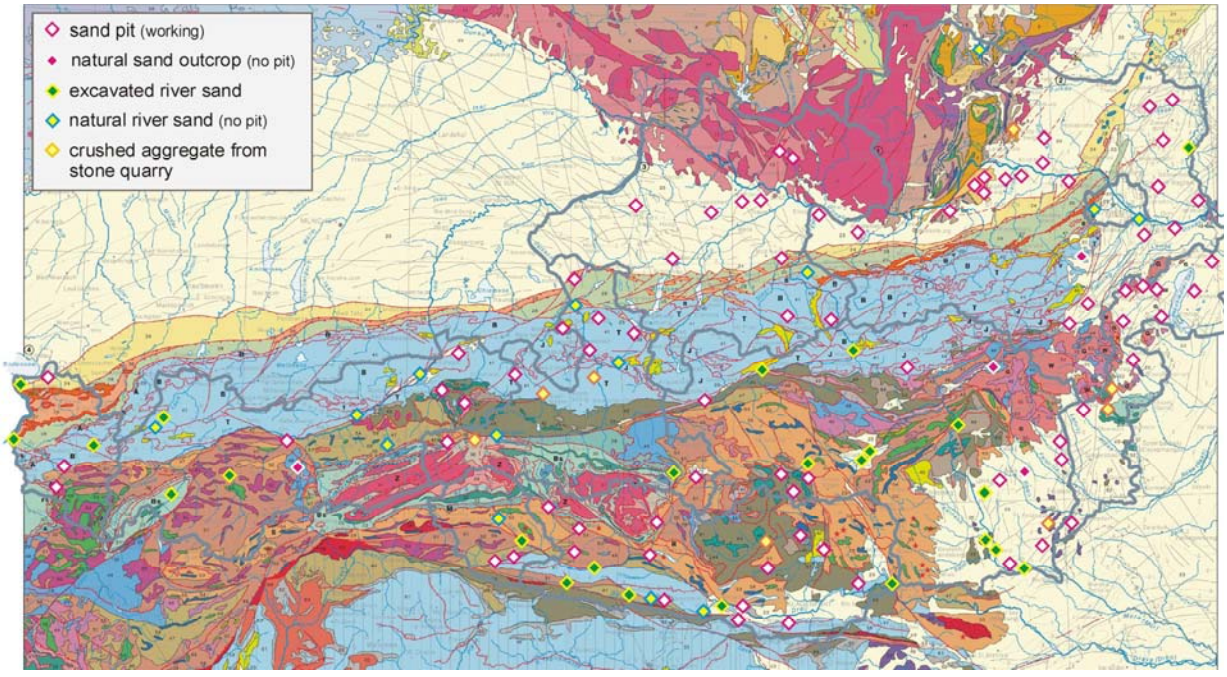

Fig. 1.: Geological map of Austria with the sampled sand pits, quarries and natural sand occurrences
1. ábra: Ausztria geológiai térképe a megmintázott homok- és kőbányákkal, ill. természetes előfordulásokkal

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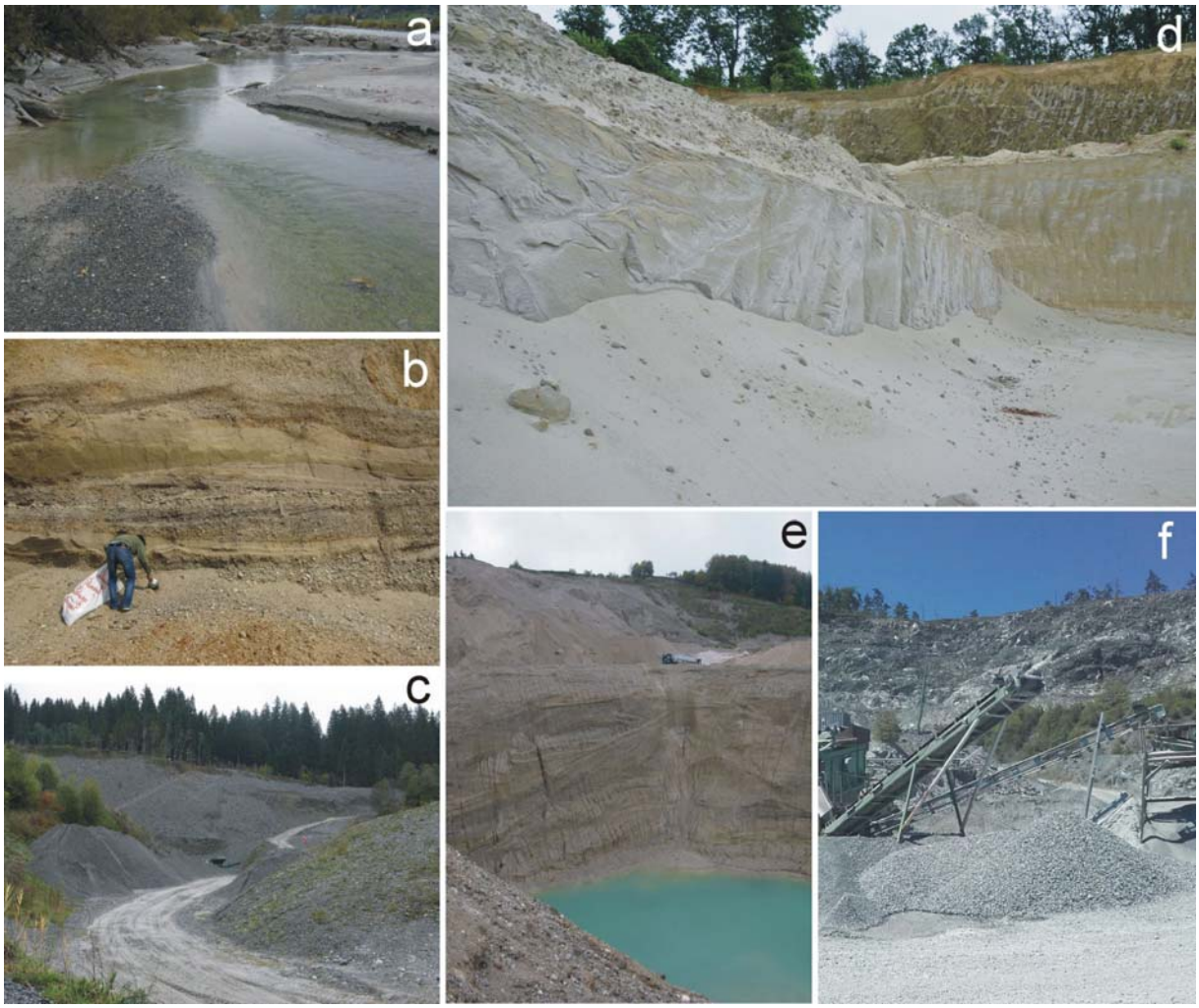

Fig. 2.: Characteristic sediment occurrences in Austria. a: river bars in the Salzach River (Salzburg Land), b: Quaternary sediment terrace of the Danube (Lower Austria), c: colluvial sediment deposit in the Central Alps (Salzburg Land), d: Tertiary marine sand deposit of the Molasse Zone (Lower Austria), e: massive glaciofluvial deposits in the Northern Calcareous Alps (Salzburg Land), f: crushed serpentinite from a stone quarry near Bernstein in the Rechnitz window (Burgenland)

2. ábra: Jellegzetes ausztriai üledék előfordulások. a: homokzátonyok a Salzach folyóban (Salzburg tartomány), b: negyedidőszaki, dunai folyóterasz-üledékek (Alsó-Ausztria), c: kolluviális törmeléklerakódás a Központi-Alpokban (Salzburg tartomány), d: harmadidőszaki tengeri homokrétegek a Molassz-övben (Alsó-Ausztria), e: vastag glaciofluviális összlet az Északi-Mészkőalpokban (Salzburg tartomány), f: zúzott szerpentinit a bernsteini kőbányából a Rechnitzi ablakban (Burgenland)

Furthermore, taking into account the main goal of the project, namely the establishment of a database containing available materials for practical work, within the defined sediment sampling areas or historical sand landscapes the commercial availability (Zötzl et al. 2013) was the most important assertive criterion. The selection of commercially available sandy aggregates with certain amount of gravel fraction (BMWFJ 2012), i.e. quarries offering natural, unwashed materials containing the grain size fractions predominantly between 0.063 and 8 mm, has also simplified the working process. Due to the plastic behavior and workability of lime and hydraulic lime mortars the presence of so-called oversized aggregates (i.e. grains > 4 mm) in the grading curve is of outmost importance to produce suitable mixes (Huber et al. 2018).

In historically significant areas where presently no working sand pits exist, mostly river bars have been sampled to get an average composition of the local materials (**Fig. 2a**). Although these sand sources are officially not available, they may provide valuable information about the use of aggregates of a smaller area in the past and thus have been included in the database as comprehensive reference materials for scientific purposes (Huber et al. 2018).

20 to 30 kg of sediment samples containing the grain size fractions from 0 to 40 mm (larger pebbles were selected manually) were collected from the selected sand pits and natural occurrences. In a few

exceptional cases, where crushed aggregates assumed to have particular importance and use (e.g. in stone conservation or by sculptors), samples from stone quarries were also taken. Photographical documentation of sediments, both on-site (**Fig. 2.**) and in the studio (**Fig. 3.**) has been carried out.

After drying the sediments in the laboratory approx. 5 g of each material containing the grain size fractions between 0 and 4 mm was embedded in epoxy resin and thin sections of standard thickness were produced and subsequently analyzed in the optical microscope (Zeiss AXIOScope A1).

Depending on the maximum grain size of the sediments 1 to 5 kg of homogenized samples were taken for the sieve analysis in order to assess the grain size distribution curves using a sieve series column containing the meshes 0.045, 0.063, 0.125, 0.25, 0.5, 1, 2, 4, 8, and 16 mm. The column was shaken for 20 minutes in a sieve shaker (Retsch AS200) and the single fractions were subsequently weighted by a digital scale. The results are presented in a graph of weight percent passing the sieve versus the sieve meshes. Due to practical considerations, both the cumulative and percentage distribution were used to present the results.

Results

General characteristics of sampling sites and sediment samples

A total of 134 samples from sand pits, natural occurrences and stone quarries (**Fig. 1.**), have been sampled and analyzed. Based on the geological and sedimentological environment the occurrences could be divided into six different groups, i.e. recent fluvial (**Fig. 2a**), Quaternary fluvial (**Fig. 2b**), colluvial (**Fig. 2c**), Tertiary marine (**Fig. 2d**) and glaciofluvial (**Fig. 2e**) types. Crushed aggregates from stone quarries (**Fig. 2f**) have been classified in a separate group. **Fig. 3.** shows the percentage of sediment types analyzed in the study. Most of the aggregates belong to the recent (43 samples) or paleofluvial (29 samples) groups. 43 samples belong to colluvial sediments originating mainly from the mountainous regions (i.e. Tyrol, Salzburg, Carinthia and Styria) of the country. Additionally, in the alpine areas four occurrences have been classified into the glaciofluvial type.

Especially in Burgenland and Lower Austria there are some well-known Tertiary marine sediment deposits (e.g the quartz sands near Melk or the siliciclastic sediments rich in fossil shells near Nexing) offering aggregates of different composition and for different purposes. Out of 134 sands, seven belong to this group.

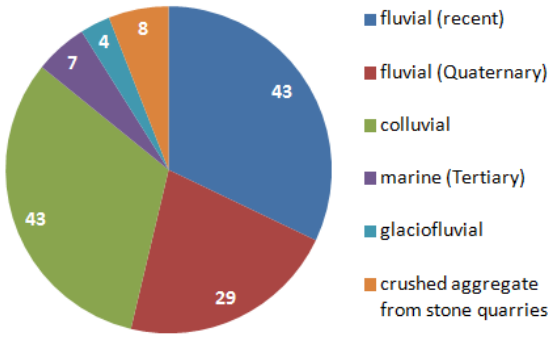

Fig. 3.: Classification of aggregates based on their geological-sedimentological origin

3. ábra: A minták geológiai-szedimentológiai származás szerinti osztályozása

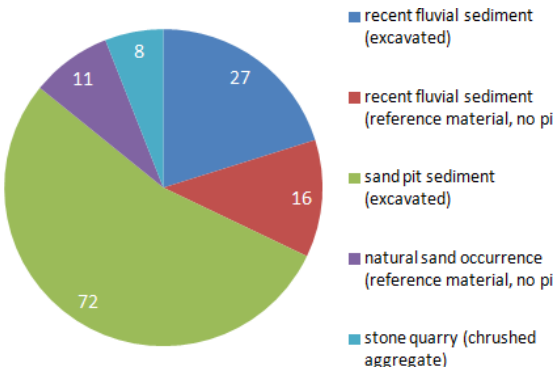

Fig. 4.: Classification of aggregates based on their yield

4. ábra: A minták kitermelés szerinti osztályozása

Finally, eight crushed aggregates of special importance, such as composition, color, etc. have been taken from various stone quarries.

A majority of the samples (107 sand samples) selected for the database were taken in operating sand pits, excavation sites from rivers or stone quarries. Due to their historical relevance, 27 out of 134 samples were directly taken from natural river sediments (i.e. river bars) or colluvial deposits (11 samples) without existing excavation sites (**Fig. 4.**)

The optical appearance (i.e. color) of sediments is basically affected by their mineralogical composition and grain size distribution (**Fig. 5.**). Thus, various sands of various origins and sedimentological background may exhibit a large diversity of colors. While the Tertiary beach sands rich in quartz near Melk are yellow to almost white in color (**Fig. 2d**, **Fig. 5d**), in the Pre-Alpine regions Tertiary to Quaternary deposits contain sometimes orange to red sands, where the discoloration was caused by the precipitation of secondary iron minerals. The color of river deposits is predominantly determined by the presence of weathering resistant silicate components.

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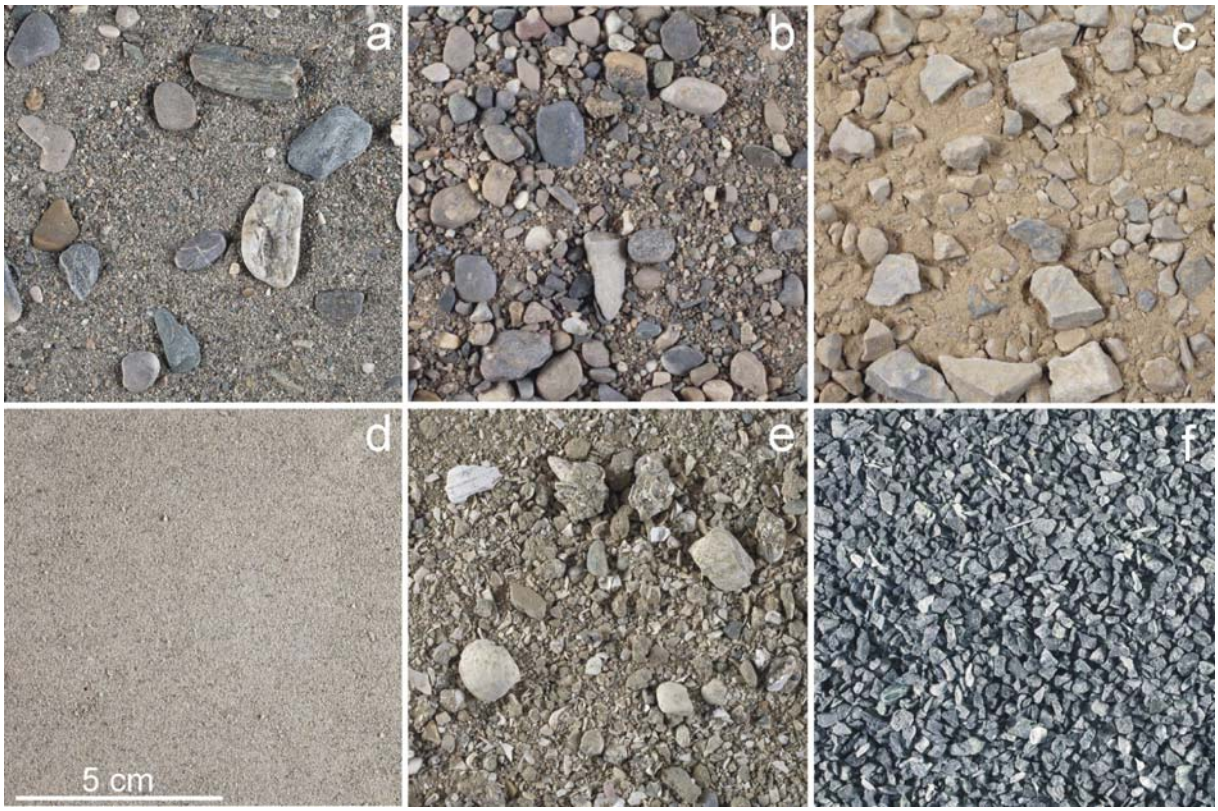

Fig. 5.: Photographs of some typical sediment types. a: recent river sediment containing high amount of the sand fraction and gravels (Inn, Tyrol), b: Quaternary fluvial sediment from a Danube terrace (Lower Austria), c: angular colluvial sediment deposit mainly of carbonate origin (limestone and dolomite), Northern Calcareous Alps (Styria), d: very well-sorted Tertiary quartz sand deposit of the Molasse Zone (Lower Austria), e: poorly sorted Tertiary coastal sediment with large amounts of siliciclastic sediments and shell fragments (Lower Austria), f: well-sorted crushed serpentinite (Burgenland)

5. ábra: Néhány jellegzetes üledéktípus makroszkópos megjelenése. a: recens folyami üledék nagy mennyiségű homokfrakcióval és alárendelten kaviccsal (Inn, Tirol), b: negyedidőszaki, dunai folyóterasz-üledék (Alsó-Ausztria), c: kolluviális, karbonátos törmeléklerakódás az Északi-Mészkőalpokból (Stájerország), d: kiválóan osztályozott harmadidőszaki tengeri homok a Molasszövből (Alsó-Ausztria), e: gyengén osztályozott harmadidőszaki tengeri üledék nagy mennyiségű sziliciklasztos törmelékkel és kagylóhéj töredékkel (Alsó-Ausztria), f: jól osztályozott zúzott szerpentinit (Burgenland)

Therefore, the main inner alpine rivers, such as the Rhine, the Inn (**Fig. 5a**), the Salzach, the Mur and the Drava are characterized by less attractive, grayish to brownish sands, where the main hue is determined be the amount and type of silicate components. Nevertheless, the origin of sediments taken from different parts of the same stream often has a visible impact of the macroscopic appearance of the material. While the sand deposits of the Salzach near the Central Alps is almost entirely made up of silicate materials of metamorphic origin causing a dark gray hue of its sediments, the deposits of the same stream at Salzburg are lighter due to the large amount of carbonate grains added to the components during the river crosses the Northern Calcareous Alps. The same refers to the sediments of the Drava collected near the Karawanks, which is part of the Southern Calcareous Alps. Due to the high amounts of fines colluvial deposits they are mainly darker in color. Nevertheless some special local deposits, mainly of carbonate nature, in the Northern Calcareous Alps may exhibit warm hues and bright color (**Fig. 5c**). Finally, the color of crushed aggregates is influenced by the source rock (e.g. marble = white, serpentinite = greenish gray **Fig. 5f**, basalt = dark gray).

Grain size distribution

Due to the large diversity of sediment types, grading curves of large variety have been identified. Depending on the main sedimentological features, similar patterns and trends can be observed in shape of the sample curves belonging to the same sediment type.

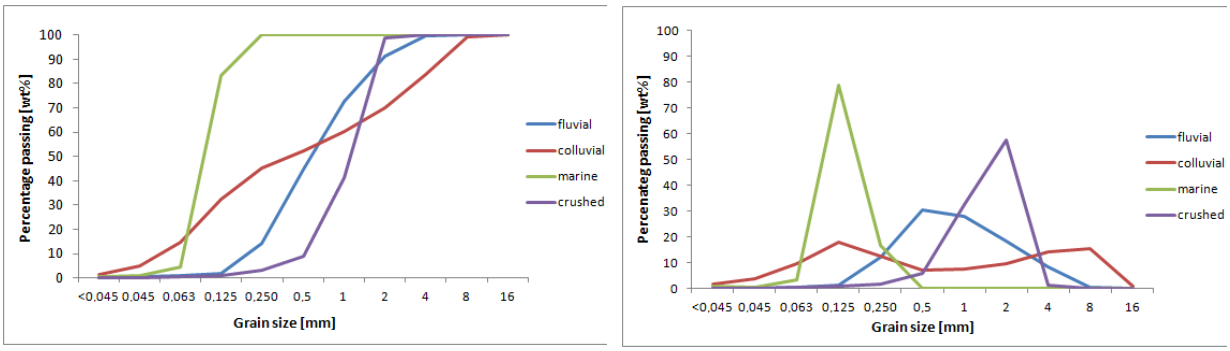

Fig. 6.: Typical sieve curves (left: cumulative distribution, right: percentage distribution) of the studied sediments. Fluvial (blue): moderately well sorted recent river sediment containing the grain size fractions between fine sand and fine gravel. Colluvial (red): poorly sorted sediment with a continuous grain size distribution between the silt and gravel fractions. Marine (green): very well sorted fine sand. Crushed (violet): well sorted aggregates of the coarse sand fraction

6. ábra: Jellegzetes szemeloszlási görbék (bal: kumulatív eloszlás, jobb: százalékos eloszlás): Folyóvízi (kék): uralkodóan finom homokból és finom kavicsból álló közepesen jól osztályozott recens folyóvízi üledék. Kolluviális (piros): gyengén osztályozott üledék folyamatos szemcseméret-eloszlással a kőzetliszt és kavics frakció között. Tengeri (zöld): kiválóan osztályozott finom homok. Zúzott (lila): jól osztályozott, durva homok mérettartományú szemcsék

Recent river deposits (**Fig. 6.**) often contain significant amounts of the fine to coarse sand fractions (i.e. 0.125 to 2 mm), low amounts of the fine grain size fractions (<0.063 mm) and varying amounts of fine to medium gravel as characteristic oversized grains in the deposits (**Figs. 5a and b**). The roundness of larger grains varies between moderate to well-rounded, indicating clearly the effect of fluvial erosion. Fluvial sediments from river terraces and older deposits may exhibit similar grain size distributions however the amount of finer fractions may be higher due to the presence of silty interbeddings.

To the second grading type belong colluvial (**Fig. 6.**) and galciofluvial sediments characterized by more evenly distributed grain size fractions often with significant amounts in the silt fraction. These sediments typically exhibit low to moderate roundness of the grains.

Sediments deposited in marine environments have either sharp grading curves where the sand fraction dominates (i.e. “beach sand”, **Fig. 6.**), or more balanced distribution due to the mixing up of siliciclastic sediments with components of carbonate origin (e.g. shell fragments). The grains observed in such sediments are typically angular to subrounded.

Finally, crushed, and thus angular aggregates exhibit a fairly good sorting, related to the artificial sieving of the materials (**Fig. 6.**).

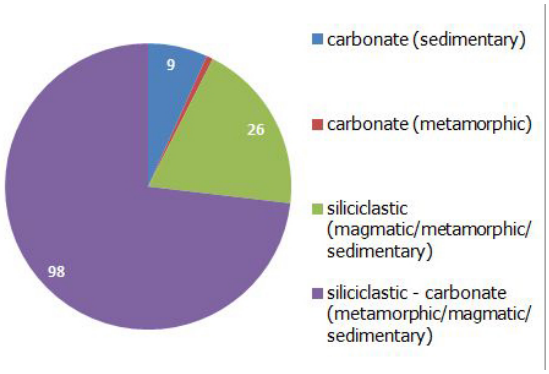

Fig. 7.: Mineralogical composition of sediment samples

7. ábra: Az üledékminták ásványtani összetétele

Petrographic characteristics

Similarly, the petrographic analysis of samples also indicates large diversity of the materials and influence of the geological build-up and sedimentary processes in a certain region. Almost three-fourths (98 samples) of the sediments contain a mixture of siliceous and carbonate grains (**Fig. 7.**). Most of the recent river deposits and river terrace sediments show the same characteristic. Small amount of carbonate grains of metamorphic origin (i.e. marble) were detected especially in the Central Alps, yet the amount of these components was negligible compared to that of the silicate grains.

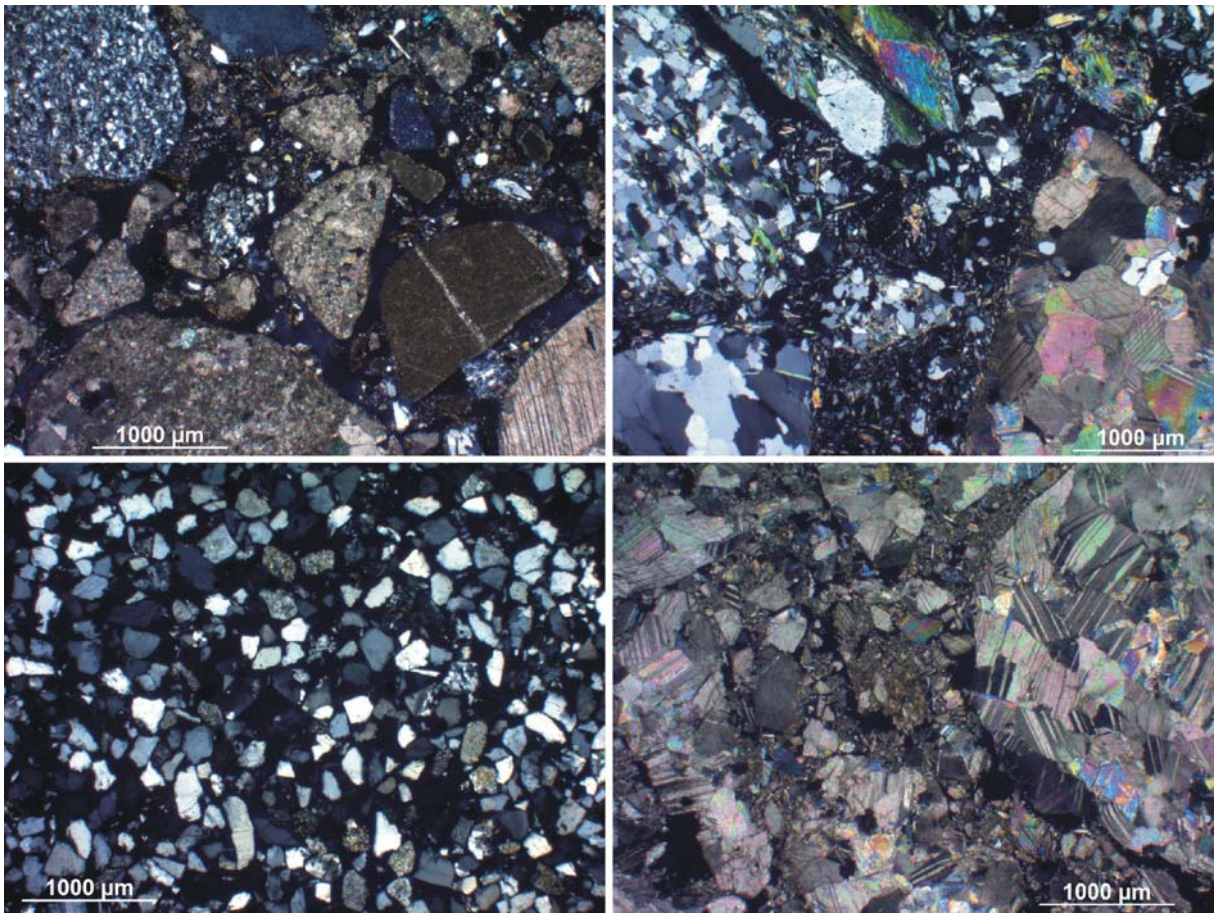

Fig. 8.: Micrographs of different sediment types (all images in XPL). a: recent river sediment containing grains of sedimentary (limestone, dolomite, sandstone, etc.) origin (Salzburg Land), b: colluvial sediment deposit containing angular grains predominantly of metamorphic (quartz, mica, quartzite, mica schist, etc.) and carbonate origin (marble), Central Alps (Salzburg Land), c: very well sorted Tertiary coastal quartz sand containing angular to subrounded grains of moderate to high sphericity (Lower Austria), d: angular grains of a crushed marble sand (Salzburg Land)

8. ábra: Jellegzetes üledéktípusok mikroszkópos képei (minden kép XPL). a: recens folyóvízi homok üledékes eredetű szemcsékkel (mészkő, dolomit, homokkő, stb.; Salzburg tartomány), b: szögletes metamorf eredetű szemcséket (kvarc, csillám, kvarcit, csillámpala, márvány, stb.) tartalmazó kolluviális üledék a Központi-Alpokból (Salzburg tartomány), c: kiválóan osztályozott harmadidőszaki tengerparti kvarchomok (Alsó-Ausztria), d: szögletes szemcsékből álló márványzúzalék (Salzburg tartomány)

River sediments reflect the main components of the geological units they crossed during their path (**Fig. 8a**). Therefore, in the sediments of the Inn in Tyrol or the Enns in Styria both siliceous (e.g. gneiss, mica schist, quartzite, amphibolites, phyllite, etc.) and carbonate (limestone, dolomite, etc.) components are present, originating from the Central Alps and the Northern Calcareous Alps, respectively. Other river sands, such as that of the Rhine, are rich in grains of the so-called Bündner schist, giving these sediments in Vorarlberg a characteristic grayish hue. While the sediments of the upper stream of the Mur River in Styria are dominated by grains of metamorphic origin (e.g. mica schist, quartzite, amphibolites, phyllite, gneiss, etc.), when striking the ranges of the Northern Calcareous Alps the amount of carbonate grains (mostly limestone) increases in the sediments around Graz and finally decreases again in the south Styrian sediments, due to the long way of transportation.

Danube sediments are also rich in siliceous components originating from the Alps and the Bohemian Massive; carbonate components were only found in the gravel fraction.

Similarly to the river sands, sediments of glaciofluvial origin show comparable composition, nevertheless the amount of carbonate components were normally higher to those of fluvial materials due to the position of the occurrences in the Northern Calcareous Alps.

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The composition of colluvial deposits (**Fig. 8b**) strongly depends on the geology of the immediate geological build-up, thus in this type of materials the number of components is smaller than in the fluvial ones. In certain cases their composition is monomictic and contains only a certain type of grain or mineral. Typical examples were found in the Northern Calcareous Alps and the Southern Alps where colluvial cones made up of dolomite and/or limestone debris are excavated for different purposes (see **Fig. 5c**).

Only a quarter of the samples (**Fig. 7.**) contained either siliceous (26) or pure carbonate (10) components. The Tertiary "beach sand" of Melk made up entirely of quartz grains (**Fig. 8c**) or the crushed serpentinite and basalt aggregates in Burgenland, crushed marble sand (**Fig. 8d**) from the Central Alps are typical representatives of this group.

Application of aggregates for mortar readjustment

As mentioned before, the project predominantly focuses on unwashed sediments containing the grain size fractions between 0.063 and 8 mm. Except for the crushed aggregates and some very well-sorted materials (e.g. the Danube and Melk sands) all sediments contain the above grain size fractions, they are thus suitable as aggregates - eventually after further sieving - for classical lime-based mortar systems. Due to the above mentioned wide range of grain size distribution, most of the investigated materials can be applied, with or without further sieving, as aggregate or filler in undercoat, final rendering, slurry or finish. Furthermore, the presence of fine grain size fractions is essential for producing durable lime mortars (von Konow 2003) (**Fig. 9.**). A few special sands, e.g. in Lower and Upper Austria, stand out due to their intensive color. The variation of beige to yellow, orange to red hue is caused by the finely dispersed iron- and/or manganese-oxides and hydroxides and has a remarkable effect on the hue of the mortar mix being one of the most important criteria in readjusting of historical façades.

In the alpine regions some of the angular colluvial aggregates of carbonate nature (**Fig. 5c**) offer a unique possibility to produce or restore historical floor screeds. After sieving, the required fractions can be applied directly in the mixture.

Aggregates made up of crushed rock fragments have a remarkable role in conservation of artificial stone and cement-based terrazzo screed structures.

Fig. 9.: Color variation of lime mortar samples made with different sands of the project

9. ábra: Különféle színű homokadalékokkal készített mészhabarcs próbatestek színárnyalatai

The grayish-green serpentinite aggregate of Bernstein (**Fig. 5f**) is one of the well-known examples used in sculptor works in the late 19th and 20th centuries. Finally, the siliciclastic sand from Nexing, north of Vienna, containing large amounts of fossil shells (**Fig 5e**), has been a well-known aggregate among sculptors and conservators and used to restore and complete the porous Tertiary limestone varieties of the Vienna basin for decades (Huber et al. 2018).

Database and sand collection

The final goal of the project is to make all data accessible for conservators, craftsmen and the scientific community. Thus, an online database is being established and released for interested persons. Scientific and general data is being collected and summarized in data sheets for each sand (**Fig. 10.**) containing following information:

position, address/contact data, GPS coordinates of the occurrence;

geological region (e.g. Southern Calcareous Alps);

type of sediment (e.g. alluvial, recent sediment) and type of sand (e.g. crushed);

processing (e.g. natural, sieved);

color;

grain size (e.g. silt to coarse sand);

sphericity/angularity of the grains;

brief petrographic characterization;

application (e.g. plasterwork);

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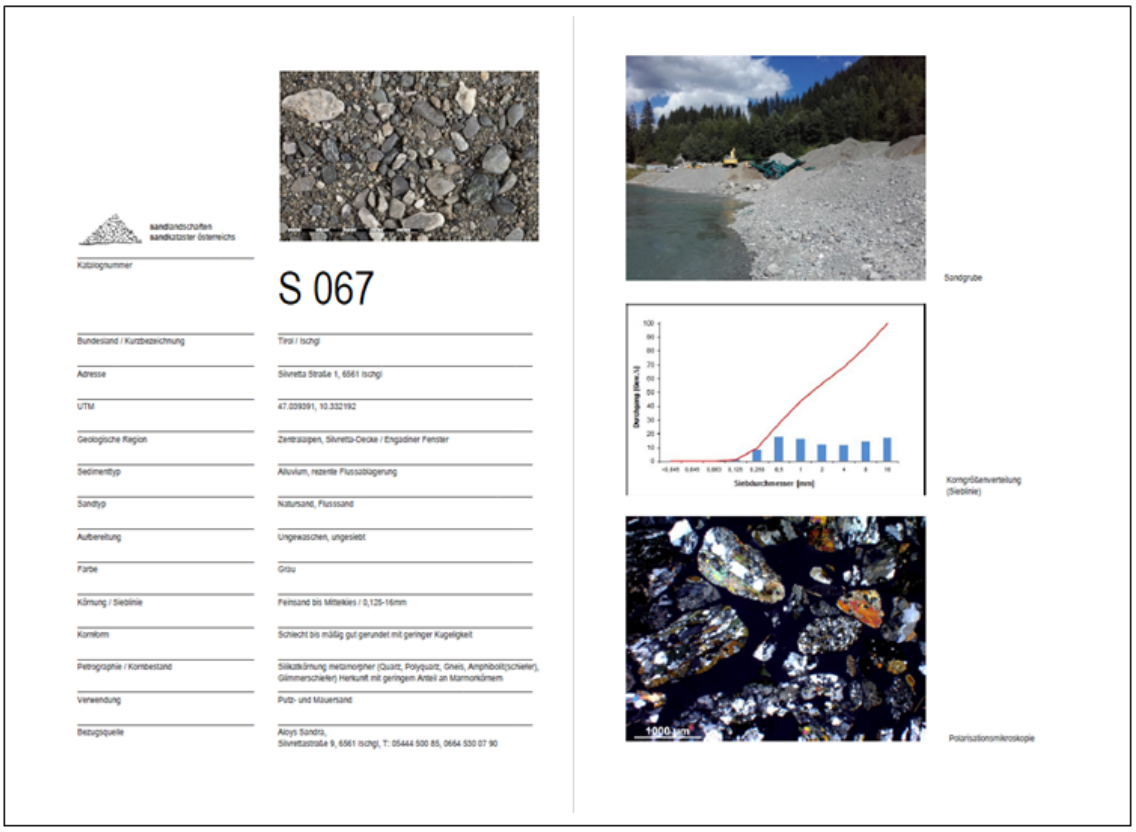

Fig. 10.: Example of a data sheet (sample S 067, Ischgl, Tyrol); page left: characteristic image of the sediment (top) and data regarding the occurrence and geological-mineralogical information of the sand; page right: picture of the occurrence (top), grain size distribution curves (middle) and thin section micrograph (bottom)

10. ábra: Példa az adatbázisban felhasznált adatlapra (S 067-es minta, Ischgl, Tirol). Bal oldal: az üledék jellegzetes képe (fent) és az előforduláshoz kapcsolódó geológiai-ásványtani adatok. Jobb oldal (képtábla): előfordulás (fent), szemcseméret-eloszlási görbék (középen), vékonycsiszolati kép (alul)

Furthermore, data sheets contain photographs of the sand and the sampling site. While micrographs taken in the polarized light microscope show the characteristic mineral components, grading curves exhibit the amount of different grain size fractions in the sediments. The complete database is planned to be published in 2020 in the website of the Federal Monuments Authority Austria (www.bda.gv.at). Additionally, a "sand depot" is stored and a sand collection of smaller dimension displayed in a permanent exhibition (**Fig. 11.**) in the Training Centre of Cultural Heritage Preservation, Federal Monuments Authority Austria in Mauerbach, Lower Austria.

Fig. 11.: Part of the sand collection and exhibition at the Information and Training Centre of Cultural Heritage Preservation of the Federal Monuments Authority Austria (BDA)

11. ábra: A BDA Kulturális Örökségvédelmi Továbbképző Központjában lévő homok-gyűjtemény és kiállítás részlete

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Conclusions

In the present study the petrological-mineralogical and sedimentological characteristics of natural sandy sediments and a few crushed aggregates from stone quarries from all Austrian Federal Lands were collected and studied. Based on the investigation of 134 samples the following conclusions can be drawn:

- most of the sandy sediments suitable as aggregates for conservation purposes such as the reconstruction of historical architectural surfaces, belong to recent and Quaternary fluvial sediments;
- in the Alpine regions many smaller occurrences yield colluvial deposits containing high amounts of the fine grain size fractions and angular grains which made these deposits interesting for special purposes, such as the production of floor screeds or colored mortars;
- crushed aggregates of special interest (e.g. color, grain size, etc.) and use are suitable for stone conservation purposes or the production of cement-based terrazzo;
- material properties of the aggregates and information regarding the sampling sites are summarized in data sheets as well as an electronic database and released online in order to support conservators and craftsmen in the future to easily choose appropriate sands for their projects in a given area;
- a sand depot and a collection are displayed in a permanent exhibition in the Federal Monuments Authority Austria where interested persons may compare and select suitable aggregates for their projects.

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