Post-Mining Landscapes in the Alps
Towards an integrated reclamation approach

The rapid structural change in the global exploitation of resources and their primary processing is causing a widespread and unprecedented growth of post-mining landscapes in both developed and developing countries (Berger 2002; Wirth et al. 2012). Whether performed on surface or underground, mineral extraction regularly leads to a radical and permanent alteration of cultural landscapes and entire ecosystems. The rehabilitation of those vast-scale brownfields normally requires complex reclamation and transformation procedures (Berger 2008). Post-mining exploited landscapes are found in densely urbanized areas, such as former coal mining districts (e.g. Ruhr, Midlands, Donbass, etc.) but also, and increasingly, in sparsely populated and economically peripheral regions (e.g. Lausitz, Cornwall, Kiruna, Gorj, etc.).

In regards to the latter, extensive mining- and especially post-mining landscapes can be found in the mountain regions of Europe such as in the Harz massif in central Germany, the Erzgebirge on the Saxon-Bohemian border, the Brecon Beacons range in southern Wales, the Sierra Morena in Andalusia and the Cordillera Cantabrica in Asturias, the Sulcis-Iglesiente mountains in Sardinia, or the Southern Carpathian in Transylvania. Outside of Europe, the Appalachians in the eastern United States and the Rocky Mountains to the west as well as the Urals in Russia. In South America, the Andean Plateau between Peru, Bolivia and Chile are some of the most prominent examples.

Regardless of the geographical location, and the nature of extracted rocks and minerals, the shrinking of mining activities in mountain regions has a negative impact on the fragile ecosystems as well as on the weak socio-economic structures. The mountain living environments, which are particularly affected by abandoned and degraded mining sites. This includes the outflow of toxic water from tailings and waste deposits – often reaching major water courses and producing extensive contamination –, increased geo-morphological instability due to uncontrolled erosion and the fragmentation or permanent loss of habitats following extensive deforestation (Langhorst et al. 2017). This leads to the outflow of toxic water from tailings and waste deposits – often reaching major water courses and producing extensive contamination –, increased geo-morphological instability due to uncontrolled erosion and the fragmentation or permanent loss of habitats following extensive deforestation (Langhorst et al. 2017).

Less evident but, equally relevant, are the impacts of deindustrialising on local communities and regional economic systems. Particularly in remote mountain areas, the vanishing of a long-lasting mining industry is hardly balanced by the development of other significant economic activities. This results in a deep and prolonged economic decline, which gradually undermines social cohesion, and fosters the loss of cultural identity. Post-industrial communities in peripheral economic regions are indeed struggling with ‘painful changes’ mirrored in growing outward-migration, unemployment, an aging of population, and the abandonment of industrial cultural landscapes and attached symbols (Storm 2016).

In the specific context of mountain and peripheral regions, therefore, two main challenges can be identified with regards to post-mining landscape reclamation. In terms of regional development, the first challenge is the functional integration of environmental recovery strategies for the mine site into a wider economic and socio-cultural regeneration programme for the local and regional community. Concerning spatial and landscape planning, a second challenge is to make the entire process of landscape transformation visible and legible, as well as open to change and inclusive of renewed human-nature interactions (Langhorst et al. 2017). Both these challenges can be only successfully addressed through a broader understanding of reclamation as a process of land re-ordering, in which physical entities (natural systems, built heritage, etc.) and nonphysical phenomena (collective memories, knowledge, etc.) are jointly considered and matched.

The newly developed system is based on the flexible and inclusive of renewed human-nature interactions (Langhorst et al. 2017). Both these challenges can be only successfully addressed through a broader understanding of reclamation as a process of land re-ordering, in which physical entities (natural systems, built heritage, etc.) and nonphysical phenomena (collective memories, knowledge, etc.) are jointly considered and matched. For this purpose, multidisciplinary and systemic approaches are required.

Reclaiming post-mining landscapes in the Alps
Despite their size and complex orography, the Alps are known to be ‘rich in poor mineral deposits’ compared to other, less prominent mountain ranges in Europe. During the last two centuries, the low economic profitability of the Alpine deposits has limited the development of a modern mining industry. The few exceptions, which have nevertheless influenced the large-scale industrialization of the Alpine regions (Gebhardt 1990), have almost entirely disappeared. Notable are the cases of the many closed lead, zinc, silver and copper integrated mines (Gorno, Agordo, Ridanna-Ridnaun, Raibl, Bad Bleiberg, Mežica), closed or downsized ore (Eisenerz, Cogne, Schilpario, Collio) as well as magnesite mines (Tux, Radenthien, Hohentauern, Breitenau), ancient salt mines (Bex, Berchtesgaden, Hallstatt, Ebensee) and a few lignite open cast mines (La Mure, Köflach-Voitsberg, Velenje). In most of these places, the decline of the local mining industry has left behind tangible and intangible traces, such as altered topographies and built infrastructures in the first case and societal structures and cultural identities in the latter case.

In the specific context of the Alps, a strong regional identity combined with the traditional touristic and recreational vocations have favoured an equal consideration of both heritage typologies in an inclusive post-mining landscape reclamation approach. This is based on the flexible and innovative combination of the two most common transformation strategies for industrial and mining landscapes, i.e. conservation and adaptive reuse of built heritage and environmental regeneration. With regards to built heritage,
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ria, Austria) and Cuneo valleys (Piedmont, Italy). Both cases
landscape reclamation and regional development in the
To better illustrate the relationship between post-mining
approaches. Examples are the restored mining and proces-
ting landscape (extensive surface excavation sites, signifi-
cant built structures, etc.), or their definitive impairment,
might led to more traditional conservation and/or fruition
approaches. Examples are the restored mining and proces-
sing facilities of Maxhitte Bergen in Chiemgau and Centro
Minerario Valle Imperina in the Dolomites, tourism-based
refurbished underground facilities such as the Salines de
Bex in Switzerland or the Salzbergwerk Berchtesgaden, and
recultivated open pits for outdoor sports such as the Mag-
nesitbergbau Hohentauern in Upper Styria.

Alpine post-mining landscapes in transition:
two exemplary cases
To better illustrate the relationship between post-mining
landscape reclamation and regional development in the
Alpine context, there are two relevant cases: Eisenerz (Sty-
ria, Austria) and Cuneo valleys (Piedmont, Italy). Both cases
have been researched in the Interreg Alpine Space project
‘trALlS-Alpine Industrial Landscape Transformation’.

The former mining and industrial centre of Eisenerz is
the birthplace of the centuries-old Styrian heavy indus-
try. The town lies at the feet of the Erzberg, a siderite-rich
mountain whose deposits have been intensively mined
for industrial purposes since 1890. As a result of decades
of surface excavations, the Erzberg has been turned into
a pyramid-shaped open pit characterized by an endless
sequence of terraces (excavation levels) of exposed reddish
ore-rich soils. After peaking between the World Wars and
lastly in the 1970s, the ore extraction in Eisenerz declined
by resource market globalization. In 2010 the mine
still produced around two million tons of ore per year and
employed 200 people, but a complete end of activities is
foreseen between 2035 and 2040. Current mining opera-
tions are still carried at the lower part of the mine, while
from the 21st level upwards a gradual recultivation and
renaturation process is taking place.

The constant downsizing of mineral extraction and
adjoining industry is mirrored in the socio-economic presu-
re, significant depopulation, shrinkage and decreased liva-
bility. Besides the open pit, other mining-related infrastruc-
tures are shaping the particular post-industrial landscape of
Eisenerz, such as the old and planned workers settlements
with their many empty buildings and, on the northern edge
of the town, the former Münichtal blast furnace site. Seve-
ral planning strategies and regional development concepts
have been developed so far to tackle the challenges of
post-mining landscape transformation in Eisenerz and sur-
roundings. Among these, the program ‘Redesign Eisenerz
2021’, which aimed to manage urban shrinkage through
the redevelopment of unused and abandoned areas, and
the ‘Eisen+Region’, focused on mining and industrial heri-
tage valorisation. An increased and successful cooperation
among the regional players, such as the LEADER Steirishe
Eisenstraße, the Montanuniversität Leoben and the steel-
making company VOEST Alpine, is paving the way to the
first concrete actions. In the disused part of the Erzberg,
for example, a research facility for tunnel design and safety
(Zentrum am Berg) has been recently established, while the
lower mining site is temporarily hosting every summer the
Rostfest open air cultural and art festival. The long-term
challenge for Eisenerz seems, therefore, to be related to
the capacity to enhance the multi-sectoral attractiveness
of its peculiar post-mining and post-industrial landscape,
a material and conceptual frame for alternative and heri-
tage-based tourism, new circular economies, and research
spin-offs.

Located within the Maritime Alps, south of the Pied-
montese city of Cuneo, the Gesso and Vermenagna valleys
have a long tradition in limestone, marl and slate excava-
tion and processing. The good accessibility and richness of both underground and surface deposits has led to the rapid development of modern lime and cement industries starting from the late 1940s. Nowadays, the harsh rocky and forested reliefs surrounding the two valleys are dotted with eleven open cast mines and quarries of different size, typology and status. Either active or closed, terraced, funnel-type or mountaintop, the mines and quarries are always linked to and integrated by major processing facilities in the vicinity – Carbocalcio calcium carbonate factory, Italcementi and Buzzi Unicem cement plants and Sibelco silica factory. The strong interdependency between the processing plants and the related mines makes the latter subject to a highly dynamic change in both time and space to fulfil the needs (or not) of the market. Most of the existing open cast mines and quarries are indeed including either active mining sites, with related crushing and transport facilities, and abandoned areas subject to designed recultivation and/or spontaneous renaturalisation.

The three only completely abandoned open pits are the ‘Monte Cross’ funnel-type limestone quarry in Valdieri, the ‘Terra Rossa’ terraced limeschist quarry in Borgo San Dalmazzo – both belong to the soon to be closed Italcementi cement factory – and the ‘Monte Saben’ terraced limestone quarry. The challenging geomorphological stability of the former mining topographies, as well as the ecosystem development in absence of human activities make the three aforementioned quarries a relevant post-mining landscape reclamation test-site for the entire region. The current strategies, being implemented under the coordination of public (hosting municipalities) and private owners (mining and cement companies) and local/regional environmental and landscape preservation authorities are mostly directed towards the environmental recovery of the abandoned mining sites. The proximity of the quarries to natural and semi-natural high-value areas, such as the Natural Park ‘Alpi Marittime’, the Rocca San Giovanni nature reserve and the wild river park ‘Gesso e Stura’, makes the recreational and touristic vocation of reclaimed post-mining sites highly desirable in the foreseeable future. A good example is the ‘butterfly path’ in Valdieri, an ecological restoration project on the Monte Saben quarry recently financed by WWF and the University of Turin, which aims to improve the habitat of a rare butterfly species (Papilio alexanor) who have settled here as well as making the altered landscape accessible to hikers and visitors. The long-term perspective and challenge for the local authorities is to ensure a proper functional and physical coexistence between active quarrying and mining sites and reclaimed/repurposed ones.

Conclusions
In the European Alps, the current experiences of post-mining landscape reclamation are strongly based on an ‘environmental’ understanding of heritage. The spatial and conceptual extension of heritage towards the entire post-mining altered landscape, to its human and natural components, as well as tangible and intangible elements, constitutes the foundation of this approach. As demonstra-

A large portion of the Erzberg open pit, in Eisenerz, is undergoing recultivation after the cease of ore surface extraction, 2017 (Photo: © August Zoebi)

The Tabanot (left) and Monfranco (right) limestone quarries in Roaschia, which supply the nearby Buzzi Unicem cement plant, 2013 (Photo: © Daniela Risso)

References

www.alpine-space.eu/projects/trails