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COAL HERITAGE FROM SOUTHERN BELGIUM: A PRESERVATION AND COMPUTERIZED MANAGEMENT OF COAL CONCESSIONS DATA

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A b s t r a c t . From the past centuries until the seventies, underground coal mining activities have played an important role in the suburban development of western European coal basins. After closure of collieries, the impact of this activity on a fast growing urban environment is still obvious and cannot be underestimated. Changes in hydrological regime, water and soil pollution, sudden collapse or ground instability are risk factors not to be minimized. Old mining and related industrial sites have now to be revalidated and underground infrastructures and city planners and local authorities cannot ignore mineshafts. This is only possible if the huge amount of available mining data is preserved and their information computerized. These mining data represent an essential component of urban geology that must be integrated in an easy access geographic information system. The old coal districts in southern Belgium serves as a case study for developing an appropriate methodology.

K e y w o r d s : coal mines, mining data, urban environment, information system, Belgium.

INTRODUCTION

The development of major cities and their suburbs reinforces the need for an integration of all environmental factors. Amongst them, geology is not always evaluated as it should be. Periodically, underground failure or collapse in urbanized areas are making headlines, calling city-planners attention to geological aspects. Considerable efforts are made to convince local authorities, Mayors and town-planners of the necessity to better take into account geological factors for sustainable development of the cities of tomorrow. The localization of underground quarries and old mines underneath urbanized areas is a particular aspect with strong environmental impact. Related problems are diverse: spectacular ground collapses, subsiding areas, failures of foundations, aquifers pollution etc. In such a context, all the available data (historical, geological etc.) on underground exploitations must be integrated in the urban geological database. Gathering these data which are scattered is an important aspect, time-consuming, but valuable. Encoding and computerizing must be done in a second phase that valorises considerably the data. The finality is that non-professional can have an easy access to a relational database, connected to a Geographical Information System (GIS). This integrated system will serve efficiently city-planners, only if the database is as complete as possible.

The present paper deals mainly with the coal-mining district of southern Belgium, which has to face major problems of post-industrial site revalidation and data management. The Geological Survey of Belgium (GSB) has developed a specific methodology to face this problems and to manage efficiently the huge amount of available coal mining data. This work, developed by the GSB, is part of a larger project dealing with other aspects of urban geology (GEOINDEC project for GEOlogical INtegrated Database for Environment and Cities).

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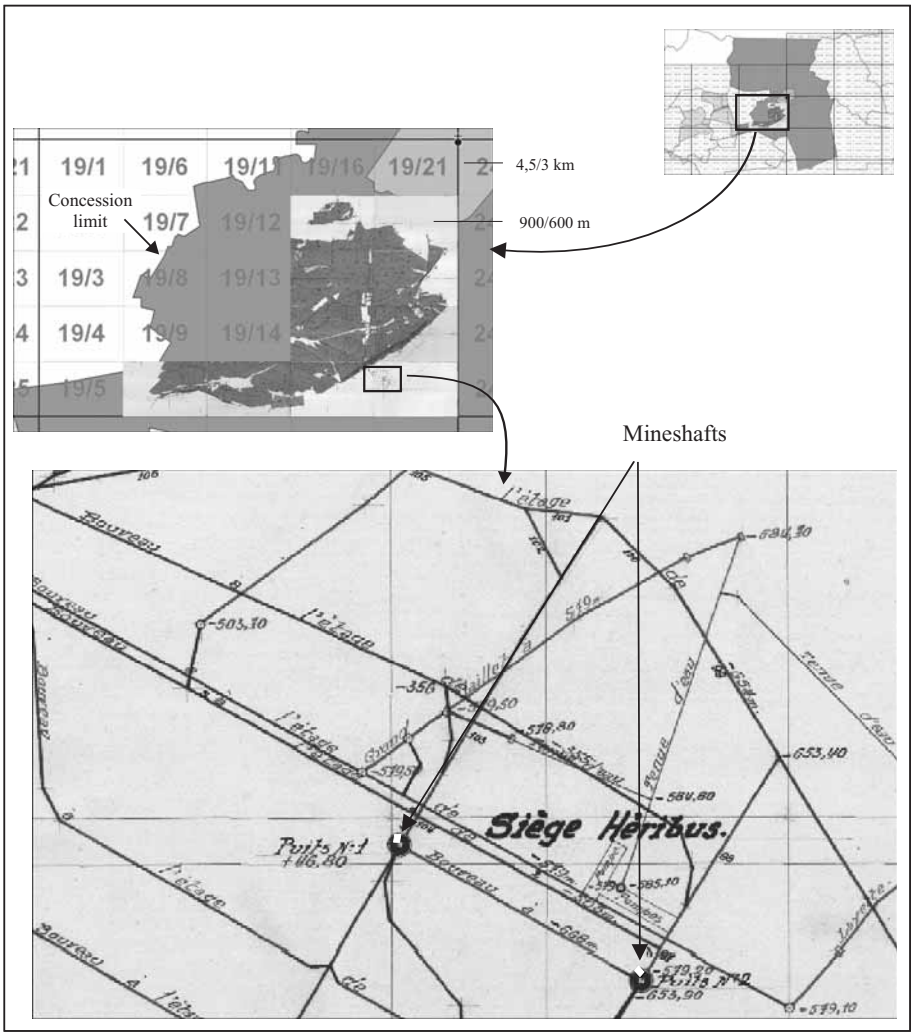

Fig. 3. Concession map, ten scanned mine plans and mineshafts database are superimposed. The precision of the method indicates a 5 meters error

name and number of the concession where the well lies as well as geographic coordinates which must also be converted in Lambert 72/50 coordinates.

Coal dumps database. The last database created at the GSB concerns the 483 coal dumps inventoried in the southern part of Belgium. All of them are related to extraction wells of collieries. Informations concerning name, localization, geographic coordinates, waste products volume, type and category of coal dump have been systematically described.

Several examples are figured in the following part to illustrate the utility of the GIS. In the first example, ten mine plans from the coal seam named "Veine à l'Aune Superieure" are georeferenced in the GIS (Fig. 3). The plans location is particularly well done in Lambert coordinates as they fit exactly the small mine grid (900 m long/600 m wide). Importing a new layer (mine shafts database), in this case, permits to measure the error between geographic coordinates of wells from database compared to the same wells drawn on mine plans (Fig. 3). The measured error, close to 5 meters, indicates a relatively good precision of the method.

Another example concerns the "Bois du Cazier" colliery (Fig. 4). Starting with a topographical map at scale 1:10,000 close to the Charleroi city, a highlighted zone is revealed on the map and zooming on this zone permits to discover more detailed technical plans. These plans correspond to mining infrastructures close to the surface (mining galleries and wells). The superimposition of these documents, with the same wells from the mineshaft database, allows establishing the precision of the coordinates (Fig. 4). In fact, the error is again relatively weak but this is not always the case. The method limitation depends on the accuracy of the mine coordinates deduced from mine plans. Some collieries have used a local mine grid which is not the official grid established by the Mine Administration. This fact is particularly a reality with the oldest plans.

A special interest concerns the superimposition of different layers in the GIS such as those of the railroads, roads and rivers network in comparison with mine plans (here the "Dure Veine" coal seam, Fig. 5). Underground mining infrastructures have a strong impact on surface human activities, especially when mining infrastructures are located relatively close to the surface. This

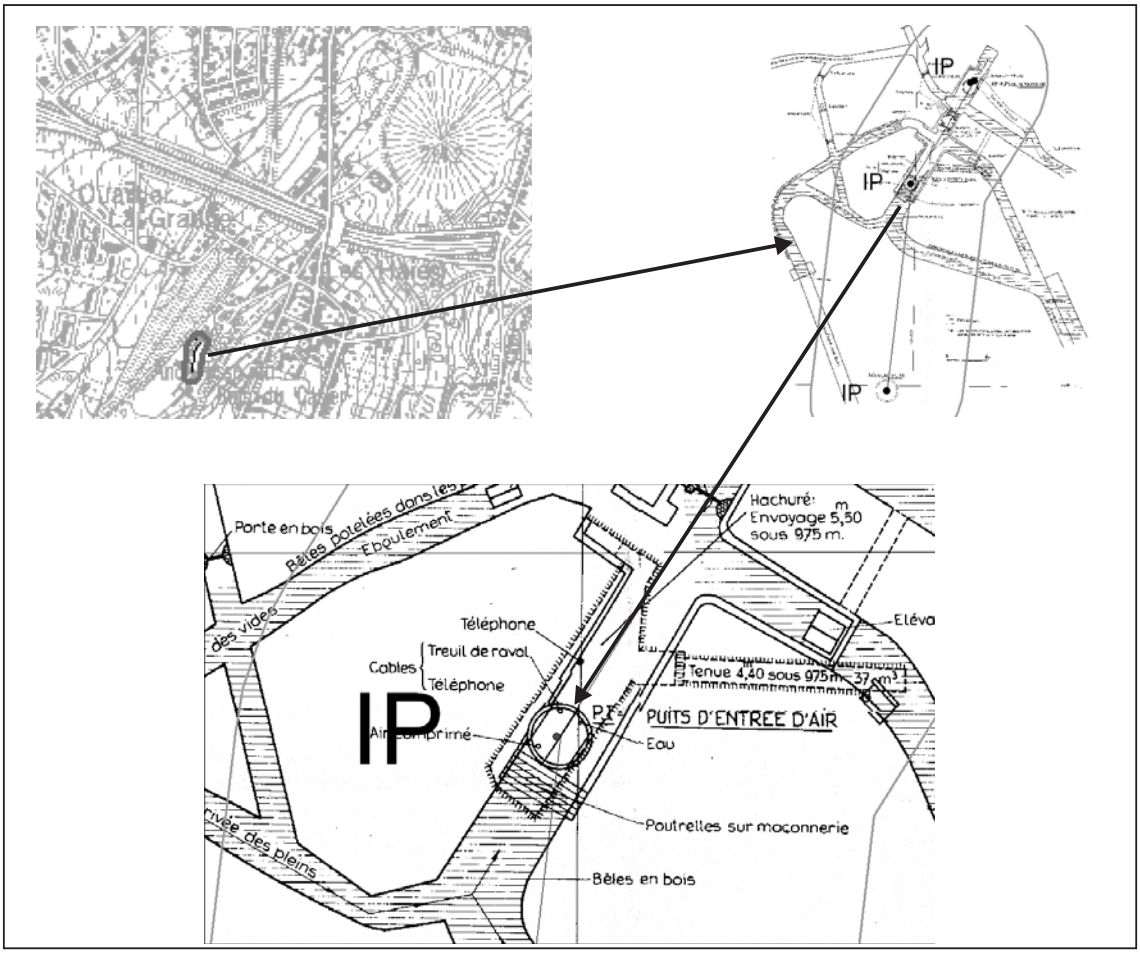

Fig. 4. Zooming on the selected area drawn on topographic map at scale 1:10,000 gives more detailed mining plans with stonedrifts and wells. A small black point from the mineshaft database are clearly seen in the middle of the wells drawn on the plans

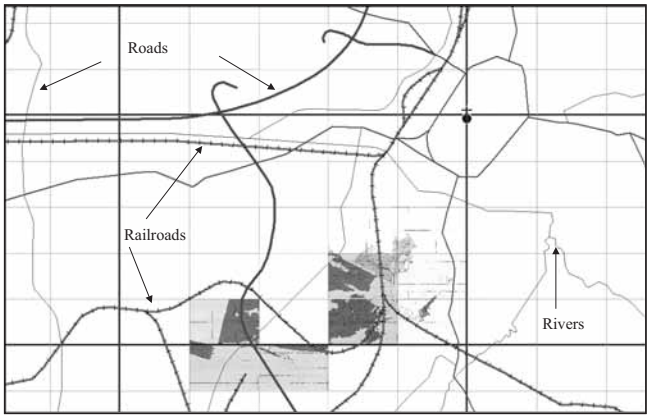

Fig. 5. Superimposition of different layers in the GIS: mine plans of the coal seam "Dure Veine" as well as roads, rivers and railroads networks

is particularly true in the southwestern part of the Mons City (Quaregnon area) where numerous mineshafts have been inventoried on mine plans (Fig. 6). In this zone, wells are found everywhere: underneath schools, roads, cemetery, railroads, houses and coal dumps with a density of 1 well for 33-square meters. Exact localization of all the mining infrastructures is therefore urgently needed to prevent new damages.

All kinds of documents —photographs, text, technical drawings, internet pages — can be attached to any geographic objects stored in the database and accessed easily (Fig. 7).

The coal mines database is a particular layer of the urban geological database. Underground quarries, metallic mines, backfillings of old quarries or topographic depressions and reworked soils will be included in the next step, following the same philosophy. Digitalized geological maps, when existing, can serve as basis layer. Each mapped formation is a geographic object with its own attributes. Areas corresponding to a given formation can, therefore, be selected and superimposed to other layers including not only underground voids, but also surface geological data (outcrops), boreholes, geotechnical tests, hydrological information etc. The list is open-ended, making the system powerful.

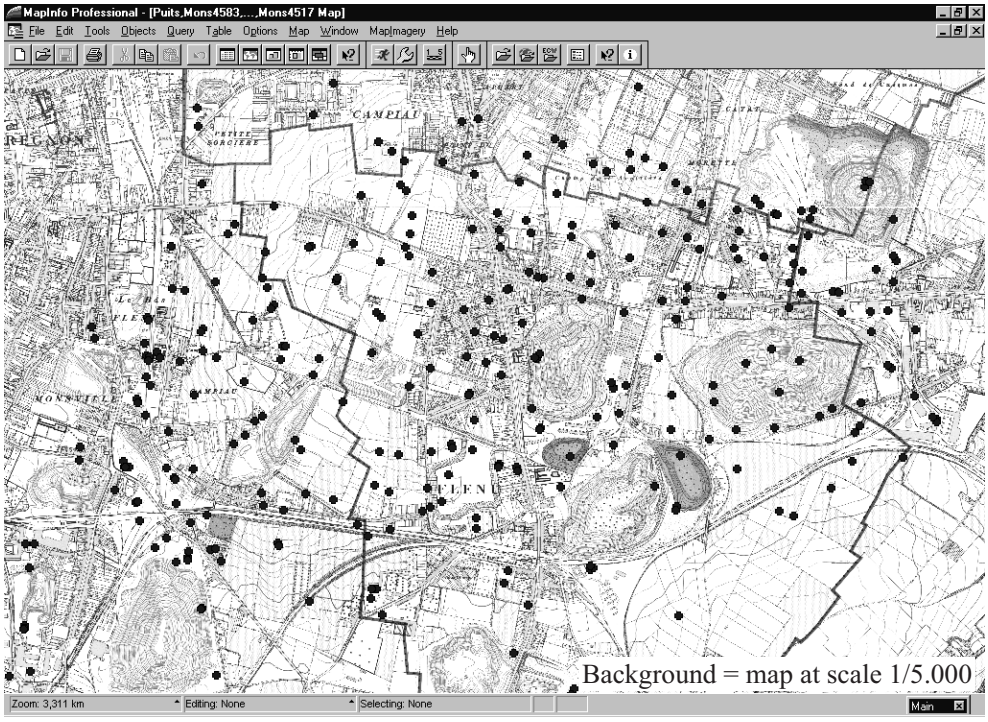

Fig. 6. Mineshafts, in the Quaregnon area, are present everywhere underneath schools, roads, cemetery etc. with a density of 1 well for a 33-square meters

Fig. 7. Wells are superimposed on an aerial photo (Mons area, "Crachet"). The info toolbox and an image are linked with a well

STATE OF ART

The creation of a GIS have permitted to develop a computer-aided management of mine documents and information research on collieries of southern coal basin of Belgium. This is the main goal of the system developed at the GSB.

The scanning phase permits to create sixty CD-ROMs, leading to the numerical preservation of approximately 1250 mine plans.

Until now, around 1300 mine plans from 4 concessions are recorded in the database. This part should be almost finished when the 114 concessions, and around 25,000 mine plans covering the coal basin of southern Belgium, will be described. This huge amount of documents implies a long working time to obtain a complete database.

483 coal dumps have been described. The waste products of some of them are used actually during roads constructions. This exploitation implies a change in the landscape and new land surfaces free for human activities. These data must be absolutely indicated and updated in the database.

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