Regolith map of South Australia **and GIS dataset: first edition**

PACE 2020 exploration mining energy global

Carmen Krapf, Jonathan Irvine and Wayne Cowley
Geological Survey of South Australia, DMITRE

Introduction

A major challenge to bedrock mineral exploration in many parts of South Australia is the need to be able to explore efficiently and effectively through extensive and thick regolith. Understanding and mapping regolith distribution and composition can be a very cost-efficient and powerful exploration tool. Regolith maps which distinguish between in-situ and transported regolith are particularly useful for geochemical sampling programs in mineral exploration. Furthermore, regolith mapping assists in the development of landscape evolution models and promotes understanding of regolith history and dispersion within the landscape.

As part of the *PACE* 2020 initiative's *PACE* Exploration program (Pathways to Discovery, Baseline Geoscience Data), the Geological Survey of South Australia has recently compiled a seamless statewide 1:2 million scale regolith map of South Australia (Krapf et al. 2012; Fig. 1) and an accompanying detailed GIS dataset that portrays regolith materials, as well as landforms and regolith overprints (induration, lag). It is complementary to existing thematic statewide maps and datasets such as geology (Cowley 1999, 2001), paleodrainage and Cenozoic coastal barrier systems (Hou et al., 2012), radiometric and ASTER mineral maps. The regolith map aims to provide a statewide representation of regolith materials and landforms and thus presents a broad-scale framework for guiding geochemical prospecting for a wide range of minerals both beneath and within the regolith, as well as addressing land use, groundwater and other environmental issues.

The South Australian regolith map will also become an integral part of an Australia-wide regolith map currently being compiled by Geoscience Australia and will, as far as possible, edge-match with other existing state regolith maps using the regolith terrain mapping (RTMAP) scheme of Pain et al. (2007).

To adequately represent the regolith for South Australia at a 2 million scale, the RTMAP scheme had to be adjusted and revised. It should also be noted that the regolith map represents the surface distribution and expression of the regolith; it does not include any information about regolith thickness, stratigraphy and age.

Map compilation

Mapping was based on the 1:250 000 geological map series and its updated digital equivalent, the 1:100 000 geology map dataset available in SARIG. The polygon linework for the regolith map dataset was newly compiled using ArcGIS 9.3 for 68 1:250 000 map sheets. For each of the 17 920 newly created polygons, 10 attributes were captured during the mapping process, including regolith materials and landform name, description, RTMAP code and map symbol, as well as the transported – in situ (TI) and residual–erosional–depositional (RED) schemes.

As mineralisation in regolith is often related to intense induration, e.g. uranium and gold in calcretes, the induration of regolith material is also displayed on the map. This information was extracted from the existing 1:100 000 geology data layer in SARIG and six types of induration captured: calcareous, ferruginous, siliceous, gypsiferous, mixed calcareous–gypsiferous and undifferentiated.

In addition, surface lag, commonly referred to as gibber, is represented as another data layer. Lag is a thin deposit of fragments larger than sand size which is widely spread over the land surface. This coarse material is left behind after fine material has been removed by wind or, less commonly, sheet flow processes (Pain et al. 2007). Information about the occurrence of lag was compiled from the 1:100 000 geology data layer together with detailed interpretation of Landsat and Google Earth imagery.

Upscaling

As spatial accuracy and linework detail was highly improved for the digital regolith dataset, a generalised dataset had to be produced for the printed version of the map. This was accomplished using the automated generalisation of the surficial geology maps module of the GeoScaler software (V 2009; Laboratoire de Cartographie Numerique et de Photogrammetrie, Geological Survey of Canada).

Deliverables

The *PACE* 2020 regolith project has delivered the following products:

- Generalised printed map of the regolith of South Australia at 1:2 million scale with induration and lag information overprinted on regolith materials (Krapf et al. 2012). Additional derivative map products include regolith landforms (TI and RED scheme) and conceptual regolith cross-sections (Fig. 2).
- Regolith digital GIS dataset based on 1:250 000 mapping, including regolith material and landforms attributes for each regolith polygon, and additional induration and lag GIS layers.

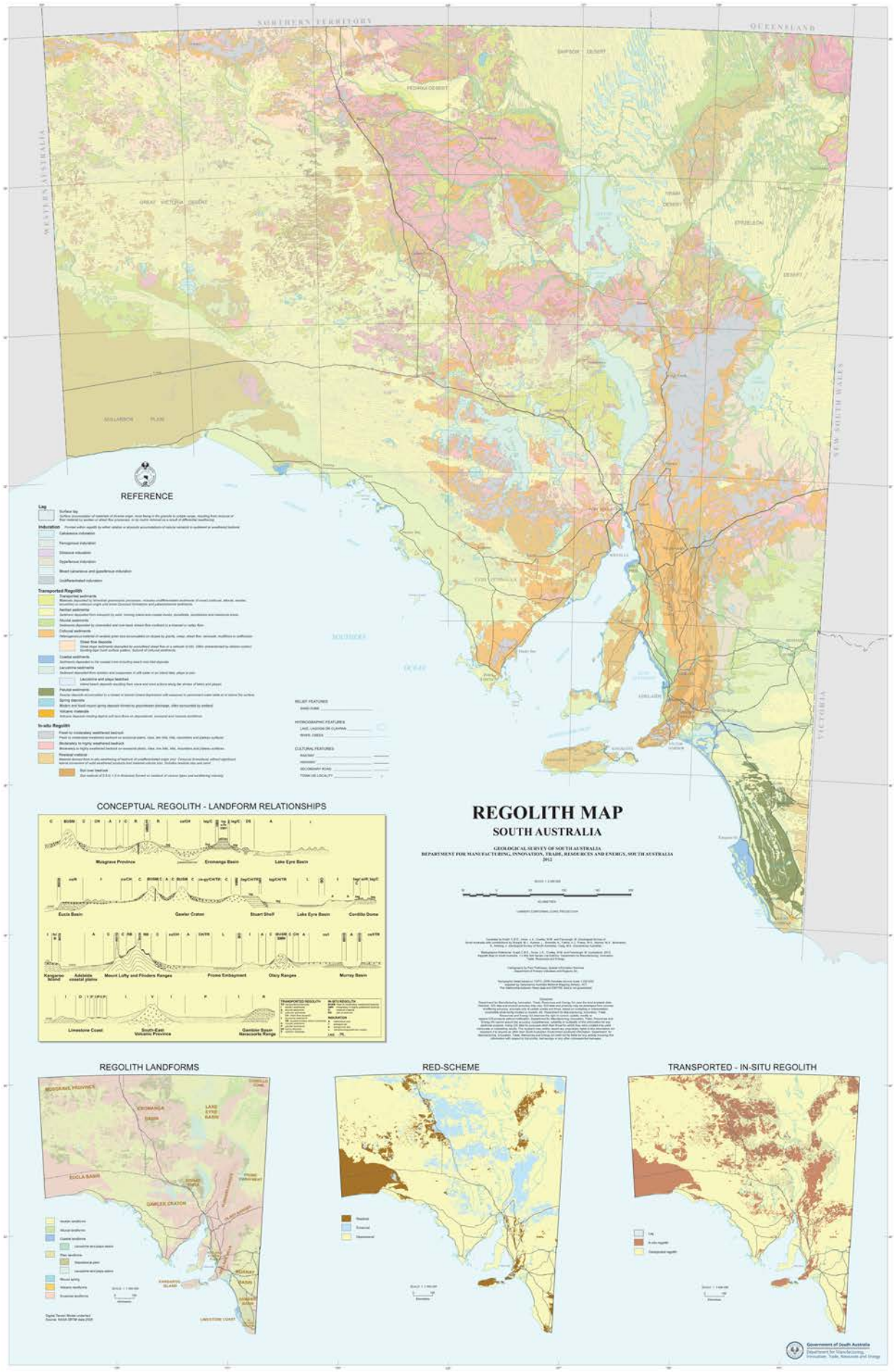

Figure 1 *Regolith map of South Australia, 1:2 million state map.*

- Report book with detailed information about the regolith map compilation and the digital dataset upscaling process, the data sources with direct web links, and an overview of major regolith features in South Australia (Krapf, Irvine and Cowley 2012) .

Future development

The Geological Survey intends to continue regolith mapping as an integral part of current geological mapping projects, focusing on the production of higher resolution regolith maps at scales of 1:100 000 and 1:250 000. This will especially allow the capture of more detail and subclasses of regolith material and landform map units.

To compile consistent regolith maps throughout the state it will be crucial to establish a standardised regolith mapping procedure based on 1:100 000 mapping. First steps have been taken by developing a regolith tab within the new digital field mapping data capture program of the Geological Survey mapping team. Field trials in the Musgrave Province were carried out in September 2012 with good results.

Feedback is welcomed and will be assessed for incorporation into future editions.

Acknowledgements

The map was compiled by the authors (also Martin Fairclough) with contributions by Malcolm Sheard, Laz Katona, Katherine Brownlie, Adrian Fabris, Wolfgang Preiss, Mario Werner, Stacey McAvaney and John Keeling (Geological Survey of South Australia), and Mike Craig (Geoscience Australia).

References

Cowley WM 1999. Revision of the state 1:2 000 000 geological map and data set. *MESA Journal* 15:20–21. Primary Industries and Resources South Australia, Adelaide.

Cowley WM comp. 2001. *Geological map of South Australia*, 1:2 000 000 Series. Department of Primary Industries Resources South Australia, Adelaide.

Hou B, Fabris AF, Michaelsen BH, Katona LF, Keeling JL, Stoian L, Wilson TC, Fairclough, MC, Cowley WM and Zang W comp. 2012. *Palaeodrainage and Cenozoic coastal barriers of South Australia*, Digital Map of South Australia, 1:2 000 000 Series. 2nd edn. Department for Manufacturing, Innovation, Trade, Resources and Energy, Adelaide.

Krapf CBE, Irvine JA and Cowley WM 2012. *Compilation of the 1:2 000 000 state regolith map of South Australia – a summary*, Report Book 2012/00016. Department for Manufacturing, Innovation, Trade, Resources and Energy, South Australia, Adelaide.

Krapf CBE, Irvine JA, Cowley WM and Fairclough M comps 2012. *Regolith map of SouthAustralia*, Digital Map of South Australia, 1:2 000 000 Series. Department for Manufacturing, Innovation, Trade, Resources and Energy, South Australia, Adelaide.

Pain C, Chan R, Craig MA, Gibson D, Kilgour P and Wilford J 2007. *RTMAP regolith database field book and users guide*, CRC LEME Open File Report 231. 2nd edn. Cooperative Research Centre for Landscape Environments and Mineral Exploration, Bentley, Western Australia.

Map. Available for purchase from Customer Services ($20, plus postage and handling), phone +61 8 8463 3000, email <Resources.CustomerServices@sa.gov.au>.

Alternatively, the PDF of the map can be downloaded from SARIG <www.sarig.dmitre.sa.gov.au>. Go to the Databases, Publications and Reports page and type DIGIMAP 00003 in the Search window.

GIS data package. Available for download from SARIG. Go to Map Layers, Geology, 2M Regolith.

Report Book. Available for download from SARIG. Go to the Databases, Publications and Reports page and type RB 2012/00016 (1.3 MB) in the Search window.

Further information and/or suggestions for product improvement. Contact Carmen Krapf, phone +61 8 8463 3128, email <Carmen.Krapf@sa.gov.au>.

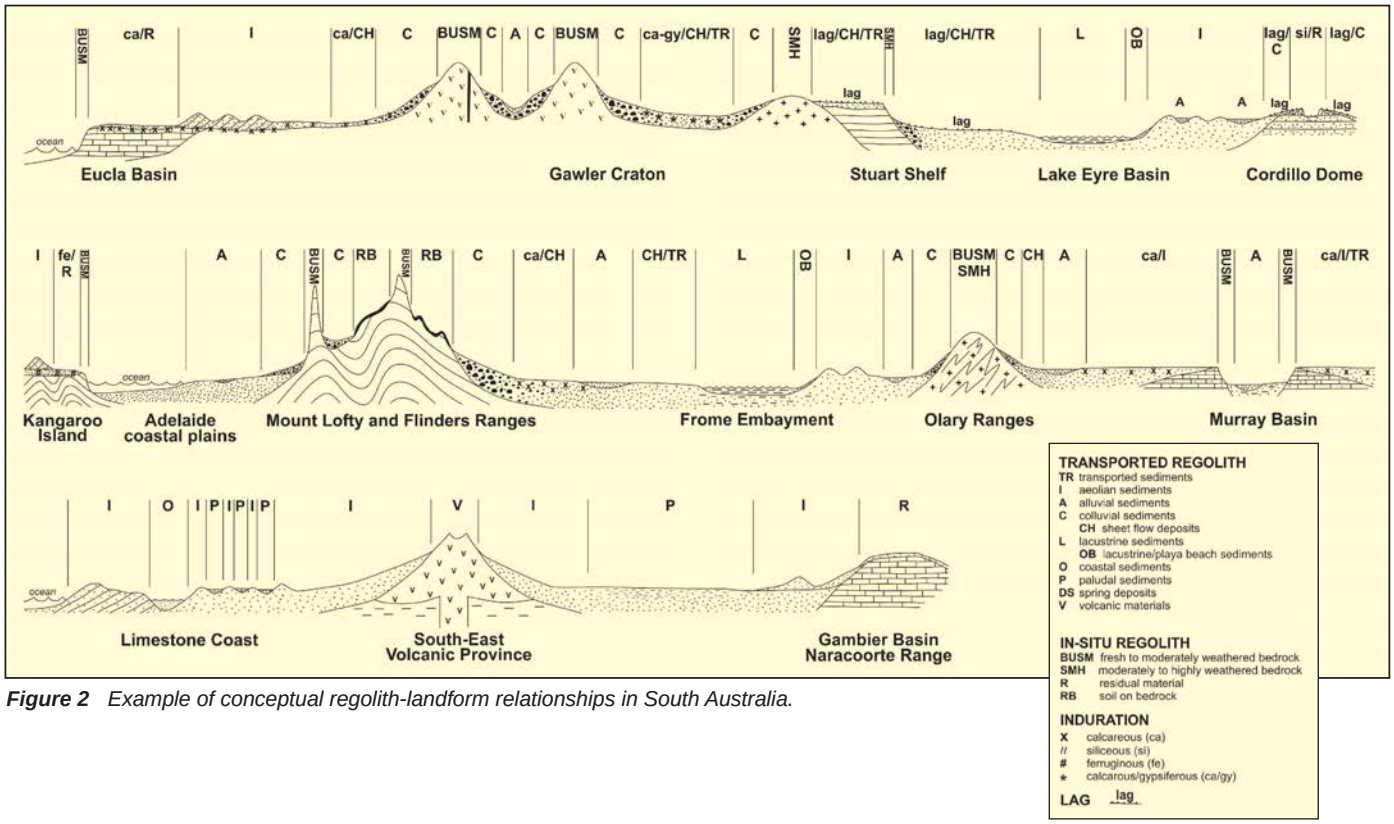

Figure 2 *Example of conceptual regolith-landform relationships in South Australia.*