Report: The geochronological database of Namibia

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The geochronological data of Namibia have been compiled in an electronical database system which can best be accessed using the ArcView software. A review of the data acquisition is followed by the presentation of the database structure and how to use it. The different fields of the database are presented.

Introduction

Geochronological isotope analysis in Namibia reaches as far back as 1954, with the Goas diorite the first rock to be dated (Nicolaysen, 1954). Since then, about 1600 isotope ages have been presented in various publications, which are often out of print and/or difficult to access. Therefore, two years ago it was decided by the Geological Survey of Namibia that all geochronological data should be compiled and transferred into an electronical database, which is easy to query and allows a quick overview of all relevant parameters of these analyses. This database is now accessible at the Geological Survey of Namibia.

Acquisition of data and database structure

The literature search for the compilation is based on articles, which are referenced in the Bibliography of Na-mibian Earth Sciences Vols. 1-3 (Hugo *et al.*, 1983; Schalk, Hegenberger, 1991, Hegenberger *et al.*, in prep). The results of this search are stored in a text file, which is part of the database. However, many of the listed articles are "barren" i.e. they do not contain new geochronological data, but rather loosely refer to geochronological or stratigraphical problems in Namibia. In addition, geochronological data are included in the database, which have been made available to the authors through personal communication, or which occur in un-published circulars, reports and theses. Therefore, the database is probably still incomplete, and any information to improve it will be highly appreciated.

The structure for the database was originally adopted from the "Proposal for the Development of a SADC Geochronology Database" (Eglington, 1999). However, it had to be modified, because in the past the majority of the Namibian isotope analyses have been published just as "age", i.e. without essential parameters listed in the proposal such as the analytical raw data, analytical errors, and statistical procedures leading to the obtained results. It is impossible to retrieve this basic information from such poorly documented ages, or to recalculate these parameters with a standardised method. On the other hand, some fields of the Namibian database do not appear in the original proposal, e.g. the author's reference, remarks and terrane.

Numerical and string data are stored in spreadsheet and ArcView shape-file format. In addition, relevant diagrams and figures of many of the published arti- cles were scanned and stored in jpg-format in separate folders.

In order to allow application of the ArcView-software each sample had to be georeferenced i.e. spa-tial information had to be assigned to the data. Three levels of accuracy can be distinguished:

(1) Geopositioning system (GPS) were introduced to and have been applied by the scientific community since the middle of the nineties and yields accuracies better than 30 m. Therefore, the geographical positions of most of the data being published since 1999 can be considered to be very precise.
(2) In the older literature about half of the sample positions are given in degrees and minutes (sometimes with quarter minutes) which corresponds to a pre-cision of at best 500 m.
(3) Other sample positions are given only in figures within the specific publication or on Geological Survey maps. To retrieve the geographical coordinates of these data, the figures and maps had to be georeferenced and sample positions determined subsequently on screen. The precision of these localities is therefore largely dependant on the accuracy and scale of the figures/ maps and may vary from a few metres to tens of kilometres. In order to allow the user some insight into the individual precision of those data, all georeferenced figures are hotlinked to their sample points in ArcView.

Usage of database

While the database in its spread sheet format can be queried with any calculation program (i.e. Excel) better results can be achieved with the ArcView software. Here, the database has been split into subsets with respect to their isotope systems plus analysed material. This allows better comparison of ages obtained with the same analytical method. The installation of the database in ArcView is described in the install.hlp file. Two views have been designed, which only differ with respect to their hotlink paths. In both views, the geological 1:1.000.000 map of Namibia (1980) serves as background for the presentation of the data (projection: WGS84, UTM Zone 33). This allows easy orientation with respect to sample positions and geological units. The individual subsets as well as the whole database occur as shape-layers on top of the geological map and can be opened if needed. In view “Figures” hotlinks refer to georeferenced figures, which show sample positions as drawn by the authors, while in view “Diagrams” hotlinks refer to the results of the specific isotope analysis. The whole functionality of ArcView applies. Queries can be carried out either on individual shape-files or on the whole database.

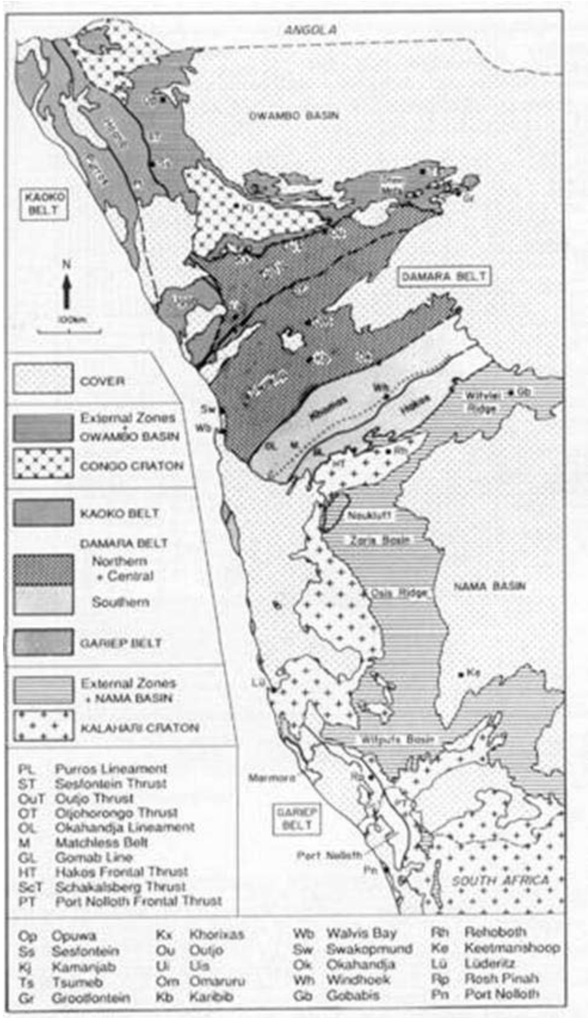

Figure 1: Techtono-stratigraphic map of Namibia (Hoffmann, 1989)

Description of the database fields

Country

This field has been introduced because geochronological data from immediately neighbouring areas within the Republic of South Africa and Angola, which are relevant to Namibian geology, have been included in the database.

Terrane/Metamorphic Complex/Era

The Namibian geology has been classified into pre-Damaran Metamorphic Complexes (Abbabis, Epupa, Hohewarte, Huab), pre-Damaran Terranes (Awasib Mountains, Kamanjab, Namaqua, Rehoboth, Sinclair), Damaran Terranes (Western, Central, Eastern and Southern Kaoko, Hakos, Khomas, Naukluft Nappe, Northern Damara, Otavi Mountains, Owambo Basin, Porth Nolloth, Swakop, Witvlei Ridge, Zaris Basin) and post-Damaran units (Cambrian to Tertiary) (Fig. 1). Pre-Damaran Metamorphic Complexes and Terranes are distinguished from each other by the fact that up to now no stratigraphy has been suggested for the former. The classification and spatial distribution of the Damara and Gariep belt into individual terranes follows the tectonostratigraphic subdivison of Miller (1983) and Hoffmann (1989).

Group/ Suite

The nomenclature for classification of geological units within this field follows largely SACS (1980) and Hoffmann (1989). However, a complete new stratigraphy has been proposed within the Rehoboth Terrane, which will be published soon. It distinguishes between the Paleoproterozoic Rehoboth and the Mesoproterozoic Nauzerus Groups, the latter being an equivalent of the Sinclair group.

The term ‘Suite’ applies to a group of intrusive rocks of the same origin, which show a wide range of compositions and are of considerable areal distribution. The terms ‘Supergroup’ and ‘Sequence’ have been omitted to keep the database as simple as possible.

Subgroup

Again, the nomenclature follows the stratigraphy proposed by SACS (1980) and Hoffmann (1989).

Stratigraphic unit

This field gives the geological formation/member of sedimentary and volcanic units, or the intrusion and igneous complex (IC). Where the authors have not classified their rocks, or used names that are outdated, the name for the specific unit has been extracted from the 1:1.000.000 geological map. Due to the often inaccurate sample position this may occasionally result in wrong labels.

Locality

Either the farm name or, on communal land, the name of the next locality has been derived from the 1:1.000.000 map. With regard to accuracy the same problem applies to this field as to the Stratigraphic Unit field.

Identity

The name assigned to the samples by the authors appears in this field to enable a literature search. The label 'NN' appears in cases where no name has been assigned.

Lithology

In most cases the author's classification of their samples was adopted. Very rarely uncommon or outdated names have been replaced by names which are recommended by the IUGS.

Method and Material

In the 'Methods' field the isotope system which has been used for analysis of the sample is listed, based on standard techniques. Uncommon dating techniques are further specified (i.e. Pb-Pb evaporation, U-Pb shrimp, single zircon). The 'Material' field gives the analysed materials (individual minerals and/or whole rocks aliquots).

Age and Age error

The age and errors given by the authors occur in this field. It would be highly desirable to recalculate ages from publications older than 1980 with statistically sound algorithms and internationally accepted decay constants (Steiger and Jaeger, 1977). However, this would require better documentation of the data than is available in most of these publications (i.e. raw data as well as assigned analytical errors are often completely missing). In order to allow some insight into the quality of the specific age, diagrams of the analyses have been linked to the sample position where available.

Initial

Where they exist, initial $^{87}Sr/^{86}Sr$ ratios have been listed in this field. All data are taken directly from the relevant publication.

Interpretation

In most cases the interpretation of the age, which has been given by the author was adopted for this field. However, some standardisation was done in order to make the data more comparable. For example "metamorphic age" was replaced by "cooling age" when mica were analysed, "overprint age" was replaced by "partial reset", while the neutral term "emplacement" is used for the origin of both intrusive and volcanic rocks.

Remarks

In this field any information that may be relevant to the specific age, apart from the more formal above mentioned fields is given (e.g. comments author's, deviation from standard procedures, quality of obtained age, etc).

Author, year, reference

Authors are listed with surnames only. If more than two authors appear the second, third, fourth, etc are combined as "*et al*". Publications are abbreviated according to the list attached to the Installation guide.doc file.

Longitude, Latitude

Geographical coordinates are given in decimal degrees. The procedure for extraction of these data from the literature has been described above.

Hotlink_diagram, Hotlink_figures

These fields are relevant only for ArcView users. They show the path to the folder in which diagrams and/or figures are stored which are linked to the specific sample point. The default path is c:\Nam_Geochron \Figures and c:\Nam_Geochron\Diagrams, respectively. If the data are stored elsewhere by the users, the pathname in this field has to be changed accordingly in all subsets.

Outlook

It is planned to maintain and extend the present geochronological database in four steps:

(1) Incorporation of new data and hitherto "undiscovered" data will be done on a routine base.
(2) The quality of the data will be assessed according to criteria which still need to be defined
(3) Available rawdata of the analyses will be brought into a format which is compatible with the software "GeoDate" (Eglington, 1999).
(4) A list of lithological units will be attached to the database, which haven't been analysed at all or only inadequately in the past. Samples of these units will be taken and heavy mineral concentrates extracted at the Geological Survey. Short explanations will be given to illustrate the importance of the individual units to stratigraphical problems in Namibia.

Figure 2 clearly illustrates that publication of geochronological data has steadily declined since 1986. It is hoped that the release of this database will stimulate and promote new research in the geochronological field, especially if one considers the poor quality

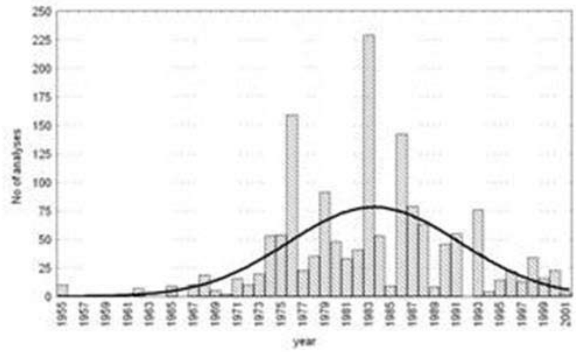

Figure 2: Publication of geochronological data from Namibia

of most of these early data as compared to the present state of the art (i.e. abrasion, single zircon and SHRIMP techniques).

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