DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

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REGIONAL GEOLOGICAL MAPPING AND CARTOGRAPHIC PROCEDURES

GEOLOGICAL SURVEY

by

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and

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(mapping procedures)

ERRATA

p. 10. para 1, line 5 - 'Range' should read 'Ranger'

p. C-3 'CURDIMURKA 252/77' should read 'CURDIMURKA 252/72'

Appendix F page numbering 'B-1...' should read 'F-1...'

p. H-1 par. 3 'In the eventof snake bite...' (to end of paragraph) should read 'In the event of snake bite the patient should be kept quiet while help is sought. If possible firmly bandage over bite and affected limb, identify snake.'

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ABSTRACT

The Geological Survey of South Australia, Department of Mines and Energy, began systematic production of standard geological map sheets in 1949. This work continues and is an important contribution to the development of the mineral, energy and water resources of the State. Base maps at a number of scales are prepared in the Map Compilation Section and regional geological mapping is carried out mainly by the Regional Geology Branch.

Using the recommended mapping procedure, the geologist records data on the central (less distorted) part of alternate air photos. These are commonly at scales of 1:15 000 to 1:85 000. Field notes are written on the back of each air photo. After the completion of field mapping and air photo interpretation the annotated photos are returned to the Map Compilation Section for preparation of a preliminary geological map, first in the form of six 1:100 000 - scale sheets, then at 1:250 000 scale. After checking, a colour manuscript map is completed with legend, cross-sections, tectonic sketch map and rock relationship diagram and passed to the Map Publication Section for scribing and other cartographic work. Printing is done by the Government Printing Division. Concurrently, the geologist writes a report on the geology of the area; field data are supplemented by the use of colour air photography, Landsat imagery, geophysical surveys, subsurface information, exploration company reports, biostratigraphy, and geochronology, geochemistry and petrology carried out by the Australian Mineral Development Laboratories.

INTRODUCTION

Geological maps and reports are necessary to guide the orderly development and management of the State's natural environment and resources. Although especially useful in mineral exploration and assessment of energy and water resources, geological maps are also a valuable reference during environmental planning, planning of engineering works, education and study of the distribution of soils, fauna or flora.

Geological mapping furthers our knowledge of earth history and, similarly to topographic mapping, is a basic aid to national development.

This report outlines present regional mapping and map preparation procedures in the Geological Survey of South Australia and is a revision of an earlier report (Forbes and Rossini, 1979). Emphasis is on 1:250 000 scale mapping and although at the time of writing the whole State is covered by geological maps at this scale, about 40 per cent are preliminary uncoloured editions of areas where additional field mapping is required before the maps can be published in the Atlas series. Some early maps in the Atlas series are being revised to incorporate new geological data. Additional geological maps at 1:50 000 and other scales are being produced as an adjunct to the 1:250 000 series, particularly over more intensively developed areas.

The writers are indebted to colleagues for contributions and critical reading of the text.

HISTORICAL

The first geological map of the State (scale 16 miles to 1 inch or 1:1 000 000 approx.) was produced by the first Government Geologist, H.Y.L. Brown, in 1883. This was a great achievement for one man. The establishment of the Geological Survey and preparation of this first map resulted from the recognised importance of the mineral industry to the economy of the State. A revised map was published in 1928 under L.K. Ward.

Systematic geological mapping began in 1949 when R.C. Sprigg supervised fieldwork in the South East and around Adelaide and Radium Hill. The first publication resulting from this work was

the Gambier-Northumberland 1:63 360 geological map which appeared in 1951. This was followed in the same year by the Adelaide, Robe and Kingston 1:63 360 maps and the PENOLA 1:253 440 (4 miles to 1 inch) map. Sections of the Survey other than Regional Mapping (later named Regional Surveys and now Regional Geology Branch) have produced a significant share of the published maps from 1951 to 1967. In 1954 supervision of regional mapping was taken over by B. Campana, later succeeded by B.P. Webb (1957), B.P. Thomson (1962), C.R. Dalgarno (1978) and B.G. Forbes (1981).

A published geological map is a reflection of the current state of geological knowledge and skill in interpretation, and drafting technique and skills. Advances in geology and cultural development eventually render a map out of date, making periodic revision a necessity.

Equally as important as the geologist's work in the production of a geological map are the various stages of drafting carried out by the Map Compilation and Map Publication Sections of the Drafting Branch. Published maps indicate the successful co-operation between geologists and draftsmen and liaison with the Government Printing Division and Department of Lands.

STEPS IN MAP PRODUCTION

Main steps in 1:250 000 map production are:

- choice of region, dependent upon current mapping programme and Departmental strategy, and setting of timetable for completion.
- ordering of air photos and compilation of base maps by Map Compilation Section.
- gathering and review of surface and subsurface data, including Landsat or similar imagery.
- preliminary photo interpretation.
- field work with continuing photo interpretation and data review.
- petrology and other specialist work.
- preparation of preliminary 1:100 000 geological maps and legend.
- progress report.
- geophysical interpretation, assessment of mineral resources and resource potential, drilling proposal.

- compilation at 1:250 000 scale and checking.
- preparation of reference column, rock relationship diagram, tectonic sketch and cross section.
- checking of colour manuscript and obtaining approval for publication.
- writing of report, Explanatory Notes and preparation of audiovisual package.
- checking final proof of map.
- publication and distribution.

Many of the above processes continue or overlap and there should be continuing liaison with the draftsman and other geologists. A progress report is often useful in assembling ideas part-way through a long-term mapping project and also makes some information available earlier. Time taken to map a 1:250 000 area varies considerably, depending on the geological complexity of the terrain. One 1:250 000 area in the Eromanga Basin took only 75 man-days to cover the limited features exposed, while in good exposures of Adelaidean rocks in the Flinders Ranges about ten times this period might be needed.

BASIC MATERIALS

Base Maps

Prior to commencement of 1:250 000 mapping, a drafting order is submitted and topographic base maps at 1:100 000 scale are prepared by the Map Compilation Section from air photos and data provided by the Department of Lands, National Mapping Division or Army Survey Corps. Prints of the six 1:100 000 scale maps covering the 1:250 000 sheet together with the appropriate air photos are issued to the geologist and constitute his basic mapping materials. While mapping proceeds, a 1:250 000 topographic map is prepared from the 1:100 000 bases.

Since 1969 the Department, in conjunction with other Geological Surveys and the Division of National Mapping, has adopted for use on all base maps the Australian Map Grid (AMG) which is a metric system of rectangular co-ordinates based on the Australian Geodetic Datum (1966). The AMG (Universal Transverse Mercator Grid) replaces the old Australian Transverse Mercator Grid which was in yards. Conversion of old co-ordinates or grid

references is difficult to do accurately because both the reference spheroid and grid system have been changed. PINNAROO (1979) was the first 1:250 000 geological map to be completely based on the AMG.

Aerial photographs

Air photos used are commonly Department of Lands colour contact prints, approximate scale 1:85 000. Air photos should be selected very early in the programme and checked on receipt to ensure that they are of satisfactory quality and adequately cover the map area stereoscopically. The Map Compilation Section prepares photos for field use and can outline on alternate air photos the recommended area in which to note geology.

PRELIMINARY OFFICE WORK

Information

An initial list of general references, Departmental reports, both published and unpublished, and open file envelopes containing exploration company reports on relinquished Exploration Licence areas can be obtained as a computer print-out for the 1:250 000 area from Computing Services. This is part of the PC-STATUS bibliographic data base, composed of the SAMREF (1953-1983) and SAMREF 2 (from 1984) bibliographies. The print-out includes an abstract of the report.

Envelopes or copies of reports may then be borrowed from the Geoscience Information Branch and Library. Useful general references include the following (see bibliography also): Metallic Exploration Index Series (maps, tables); South Australian Yearbook; Environments of South Australia (CSIRO Div. of Land Use Resources, 1977); Handbook of the Geology of South Australia (S.A. Geological Survey, 1969); A Guide to the Geology and Mineral Resources of South Australia (Ludbrook, 1986); excursion handbooks (eg. Eighth Australian Geological Convention, 1986); Transactions of the Royal Society of South Australia; Journal of the Geological Society of Australia; Australian Journal of Earth Sciences; AESIS (Australian Earth Sciences Information System); ERISAT (selected titles from the Australian Mineral Foundation).

The use of the Library is explained in Appendix I by J.A. Hutley.

The latest list of Petroleum Exploration and development titles and Exploration Licences (with map) and a consultation with the Oil, Gas and Coal Division and the Chief Geologist, Mineral Exploration, will indicate exploration activities in the area. This will allow initial and continuing consultation with company geologists so that there may be a useful exchange of information. Similarly, contact should be made with any academic geologists working in the 1:250 000 area.

Other sources of information are geophysical, topographic and geological maps, rock specimens and drill core stored at the Core Library, Glenside : an up-to-date print-out of the index to this is available. If no recent geophysical interpretation has been made of the map area, the Geophysics Branch should be approached. Geoscience Information maintains a Bore General computer file, plans showing positions of bores and collections of colour slides and black and white photographs. Print-out of the photograph index is on a 1:100 00 area basis. For those rock specimens filed in the RS system, plans showing locations are kept in the Drafting Branch and some details (RS forms) for each specimen are kept in files under 1:100 000 areas in the Regional Geology Branch.

Products of remote sensing

The most-used of these products have been conventional air photos and Landsat imagery. More refined remotely-sensed imagery is becoming available and information on this may be obtained from the South Australian Committee on Remote Sensing (SACORS).

Photographic representations of Landsat scenes in false colour can be purchased from the Australian Landsat Station through the Chief Drafting Officer, who can also check whether imagery is already available for the area of interest. The imagery is currently derived from the multispectral scanners of Landsat 4 or 5 which have a resolution of 80 m. When singals from the thematic mapper of Landsat 5 can be received in Australia, improved imagery with a resolution of 30 m should become available. Computer compatible tapes are also provided by the Australian Landsat Station, but these require the appropraite equipment and expertise to manipulate.

A more recently recommended method of study of imagery involves purchase of a 1:1 000 000 scale transparent diapositive of a Landsat scene and photographing this in four to six segments with a 35 mm camera. The 35 mm colour transparencies are then studied by projection onto a horizontal glass plate.

Other remote sensing with possible application to geological mapping includes SPOT, a French satellite to be launched 1986, which will achieve down to 10 m resolution, and the use of scanning devices on aircraft. These include multispectral scanners such as MEIS-II (linear array scanner) and TIMS (thermal infrared), and synthetic aperture radar.

Some useful references include Colwell (1983: Manual of Remote Sensing), Jupp et al., 1985, Southworth, 1985, and Goetz et al., 1983.

Photo interpretation

A stereoscopic study of air photos allows a preliminary appraisal of the map area, location of outcrops and planning of field work. A helpful background to photointerpretation techniques is given in AMF course notes (e.g. Australian Mineral Foundation, 1986). Currently a recommended stereoscope for office work is the Zeiss N2 mirror stereoscope with optional 3 x magnification and moving base plate with magnets. For field and brief office inspections a pocket stereoscope may be used. For extended study of air photos and simultaenous examination by two people the Zeiss (Jena) Interpretoscope is available in the Drafting Branch. This also facilitates height measurements. There should be little marking of the photos at this stage and subsequent annotation should be done in a way that obscures the minimum of detail. However, any unwanted wax pencil or ink mark can be removed by careful light wiping with a soft cloth moistened with methylated spirits. If it is unlikely to obscure areas of geological interest, marking of such features as homesteads, names of creeks, bores, hills and other geographic features can be done. Similarly, isolated points of potential geological significance can be marked with wax pencil. Some sets of colour air photos, especially those not intended for a standard mapping project, should not be marked, but be covered by a transparent overlay. Marking should be done only on alternate

photos, avoiding the marginal area of the photo, where there is greater distortion. Except where the background colour or shade of the photo renders it impractical, black ink is recommended for showing actual field observations. Currently the black ink cartridge of a "rotring - rapidograph ISO" pen is a favoured medium which stands out well on brownish coloured air photos. A fine line, such as that produced by an 0.18 mm nib, is desirable, to avoid unnecessary obliteration of detail. If not already typed or written on the backs of photos supplied, the air photo number, run number and survey number should be entered there for future convenience. This is normally carried out by the Map Compilation Section. Notes on the preliminary interpretation can be conveniently entered in the field note book and locations of special interest marked on a 1:100 000 base map.

Since some place names may be prone to mis-spelling it is useful to list these in their correct form. Correct spelling is usually found on Department of Lands or other official maps, but if necessary, recourse may be had to the Geographical Names Board in the Department of Lands.

The Map Compilation Section should be asked whether they require additional topographic information.

FIELD WORK

Aim

The aim of field work is to identify and delineate in detail appropriate to the scale and purpose of the project sedimentary, igneous and metamorphic rock units, mineral deposits and their relationships, indicate the geological structure and gain sufficient knowledge of the area for the publication of a map and report. To adequately describe an area the geologist will need to have information on the subsurface through previous or newly recommended drilling and he will need to consult specialists such as the geophysicist, palaeontologist and petrologist.

Preparations

The opinions below are given by F. Mosely during a discussion among members of the Geological Society of London in 1977 (Taylor, 1978, p. 475): "... The training of a field geologist should aim at objectivity and those flights of

imagination, so tempting and at times valuable, should be reserved for special pages of a field notebook. This objective information was, therefore, to be recorded on field maps and in field notes in such a way that others could take the documents into the field, locate with ease the exposures listed and get the same answers to lithologies, geological boundaries, structural data and so on. It was common experience to find that data were recorded in such a random and chaotic manner that after a lapse of time not even the original observer could interpret the results satisfactorily. In such a case the ultimate publication or report must suffer. There was a place for imagination and intuition in field geology, and it was true to say that many major advances have been intuitive, but it could not be stated too strongly that this facet should not be interpolated with what, for want of a better expression, might be called the factual observation of a field map and notebook." Also, by H.A. Vachell: "In nature there are no rewards or punishments: there are consequences."

Preparations

The following are notes on items associated with normal 1:250 000 mapping arranged in approximate order of action.

Field Programme: in conjunction with the Chief and Principal Geologist, and with colleagues, make out a tentative programme for field work, avoiding public holidays as much as possible. Prior approval is required from the Chief Government Geologist for official work on Sundays and Public Holidays. For reasons of economy, working periods of at least three weeks should normally be spent in areas over 500 km distance from the office. A rough comparison between field work of two weeks and three weeks duration, in an area about 650 km from the office, shows that between early May to early November field work in periods of three weeks would achieve 96 field days costing $3 120, but two-weekly periods would provide only 72 days costing $4 160, using the same basis of comparison. If Field Assistants, Technical Assistants or Drivers are to assist in field work, approval should be obtained from the Chief Government Geologist for any proposed overtime hours to be worked. Maximum hours allowed are normally no more than 9 hours per day for 6 days per week.

Entry conditions: Work in the Woomera prohibited area needs approval in advance - a letter should be sent following the format used in the relevant file (Security File SR 1/10/2). Requirements in other areas are as below.

National Parks: inform the relevant Range of intentions.

Areas reserved for military purposes: obtain prior approval from the commanding officer.

Aboriginal Lands: discuss proposals with the Chief Government Geologist. Adequate notification of proposed entry onto the lands must be given. Travel in Pitjantjtajara and Maralinga Lands must be preceeded by third party insurance arrangements made through the Supply Officer.

If local property owners in remote areas are not personally known to the geologist, an official letter should be sent at least three weeks prior to field work, informing them of the proposed work. They can be told of subsequent movements by personal contact. If drilling or extensive sampling is to be carried out there is further need for prior discussion with local people or authorities affected.

Paper work (see Appendix C): forms are provided for most requisitions and to simplify accounting the Branch debit number (e.g. 36 G 36 V01 for vehicle hire) is required on many of these.

Transport: initial requirements for transport and equipment should be made known to the Transport Officer some weeks before departure. Check-lists of equipment are given in Appendix F and include first aid kit and fire extinguisher.

Heavy four-wheel-drive vehicles may be needed for shifting caravans or carting large quantities of gear, particularly in remote areas, but in some areas these can be replaced or supplemented by small four-wheel-drive vehicles after establishment of a base camp. Some lighter vehicles (e.g. Daihatsu or Suzuki 4 WD) are sometimes superior, particularly in areas of soft ground or where turning space is minimal. Currently the Subaru 4 WD is the most economical and suitable vehicle for mapping where a large carrying capacity is not needed and where limited off-road work is required.

Departmental hire rates (cents per Km) of some commonly-used vehicles are as follows: 4-cylinder wagons, 17; 4-cylinder diesel, 20; 6-cylinder diesel, 30.

Fuel: in outlying areas it may be convenient to order delivery to a suitable location. Local permission may be needed for location of the dump.

Approximate fuel consumption (litres/100 km) provided by the Transport Officer, for some current vehicles:

Commodore station sedan	12
Subaru " " 4WD	9
Nissan Patrol 4WD diesel	14
Toyota Landcruiser 4WD "	14
Daihatsu utility 4WD "	10
Holden 1 t. utility	22
Ford 1.5 t truck 4WD diesel	25

Wherever possible fuel must be purchased from Mobil using a special credit card provided in the vehicle. Where Mobil fuel is not available, a Local Order book can be used for purchase.

Radio: should be ordered through a Principal Geologist from the Geophysics Branch which provides an instruction book. A whip aerial should be requested. The radio should be the type which can be left on permanently on the mute setting so that emergency messages can be taken at any time during the day. This procedure is specially useful for inter-vehicle communication on 2140 kHz frequency. Radio transceivers are licensed for Departmental business only and the normal Departmental rules of confidentiality should be observed. Priority is given Departmental long-distance (7366 Khz) calls on or after the odd hours of the day and calls should be as brief as possible. There is an emergency monitoring service. The Royal Flying Doctor radio base provides a telephone linkage if required (e.g. VNZ Port Augusta, 6890 Khz).

Mapping and auxiliary equipment: requirements depend on personal preferences and terrain: See Appendix D. The Regional Geology Division holds a number of 35 mm SLR cameras with standard, wide angle and macro lenses and other auxillary equipment. Hammers, lenses and some other field equipment are available from the Drafting Branch or by purchase.

The scale of the Brunton compass can be rotated to read true bearings for a given magnetic declination. Where a unique direction is not required the value between 0 and 180 is most convenient to record in the field eg. record a strike of 090 rather than 270.

Expenses advance: an advance payment on travelling expenses may be obtained from the Accountant (Advance Account form).

Reservation: of seats on public transport or accommodation should be made in advance through the booking clerk.

Food purchase: a check list of food items is in Appendix G.

Field location book: This is kept in the Regional Geology office. Details of the proposed field work should be entered - date of departure, date of expected reappearance in office, pastoral/telephone/radio addresses, working area. Principal Geologist and colleagues should be informed of general plan.

Final check: a few days prior to departure, arrangements should be made with the Transport Officer for loading and checking the vehicle and radio installation. In particular, the tool kit should be correct; tyre pump and hydraulic jack with jack handle should function properly and wheel braces should fit all wheel nuts. The Depot normally attends to this, but a personal check should nevertheless be made. Emergency items such as tool kit, shovel, first aid kit, fire extinguisher, radio aerial and jacking boards should be packed so that they are readily accessible. If there is a likelihood that roads will be impassable, do not depart without making enquiries.

Methods

Safety, public relations

It is well to have an eye to safety and good public relations as well as the technical approach during regional mapping. The geologist should make courtesy calls on local people and keep them informed of his movements and should leave gates as he finds them. Before entering a quarry, permission must be obtained and arrangements made with the manager. Hard hats must be worn and also, possibly, safety glasses and boots.

It is desirable that at least two geologists (with two vehicles) map a 1:250 000 sheet to ensure greater security, reasonable speed in completion of the project and to allow discussion of results on the job. Unless geologists are resident near a telephone, the office should be contacted at least three times weekly to notify movements and in case of any enquiries, messages or new instructions. A first aid kit, adequate food and water and a fire extinguisher should be carried in all vehicles and geologists should be aware of fire danger and bush fire regulations. The field geologist should maintain daily contact with a colleague or local people, advising them of his working area. Care should be taken to keep a camp area tidy and to avoid disturbance of fauna, flora and cultural sites. Rubbish should not be buried, but placed in a suitable container and delivered to an established (e.g. local council or resident's) rubbish dump or bin. Location of the camp should be such that there is the minimum waste of time travelling to place of work and travelling for supplies.

Vehicles

It is important that vehicles used in field work be reliable and serviceable: below are some relevant notes. Local purchase of tyres, batteries and spare parts should be avoided since they can be provided much more cheaply from the Works Depot.

Prior to use each day check engine oil and coolant, battery, brake and clutch fluid. Make frequent visual inspection of road springs, tyres and wheel nuts: ensure that wheel nuts are tight after a wheel change. Except for an emergency stop, apply the handbrake only when the vehicle is stationary. Avoid changing down gear while travelling at high speed. Engage front drive hubs before entering country that may require four-wheel drive, and disengage later when appropriate (e.g. before highway driving). Observe speed limits and treat the vehicle with care at all times. Some features to beware of are narrow creek channels where deep, sharp banks, rabbit or wombat burrows, tree stumps, logs, and stakes. Check doubtful areas, such as damp mud, margin of salt lake, deep water or soft dry creek sand on foot before proceeding. Carbonate-cemented crusts can be hazardous around mound springs. Creek channels can often be crossed at junctions with tributaries.

Lock vehicle before leaving in a populated area or near a highway. In remote areas it is probably safer to leave the key in the vehicle, to avoid loss of key. If there is no shade available the vehicle can be kept to a more comfortable temperature in warm weather if it is parked with the rear to the sun. If the vehicle's battery is becoming flat it should be parked facing down hill so that a running start may be made. In a steep situation it may be necessary to have handbrake on, the gear lever in first gear and the wheels chocked, for safe parking.

While travelling on dirt roads, entry of dust into the vehicle can be greatly reduced by closing all windows and having front vents open and fan on; this pressurises the interior of the vehicle.

Where convenient, public transport can be used to travel economicaly to and from the field area, once a camp has been established. Vehicles not undergoing servicing should be left at a police station, government depot or where a responsible person can keep an eye on them. Caravans should be similarly left, although in some remote areas they can remain on site.

Mapping procedures

Initially, a general reconnaissance of the area should be helpful in gaining an idea of the full spectrum of mapping units, and access, camp sites and water sources. Delineation of map units is made by a combination of traverses across the strike, photo interpretation and following selected map units along strike. Much walking may be needed in complicated areas such as crystalline basement where air photo enlargements can be used to facilitate recording of adequate detail. Vehicles aid mainly in mapping along strike and traversing relatively featureless areas. In such areas, if only to show that a traverse has been made, frequent symbols should be shown of surficial deposits en route. All roads in the area should be traversed and data relevant to future access, such as fences and gates, should be noted in the course of mapping geology. Opportunity can be taken to collect water samples, if the Groundwater Branch is not to do this.

On the face of the photo the following kinds of detail should thus be drawn finely and neatly, with reference to north at the top:

geological boundary - fine, black line (black shows best on most colour photos);
unit symbol - e.g. Qha, Pmk;
rock symbol - symbols for rock types such as granite, limestone or surficial gravels;
standard structural and facing symbol;
number referring to notes printed on the back of the photo;
symbols for road, building, well, mine, quarry;
name of feature such as homestead, earth tank, peak, well (unless they are likely to obscure valuable detail).

Only alternate photos of a run should need to be used and marking should be kept away from the extreme margin of the picture. The unmarked photo of a stereo pair is particularly useful in providing needed detail that is obscured on the marked photo.

On the back of the photo the following items may be neatly, legibly and finely registered:

near top left (with reference to north at top), name of geologist and date;
numbered notes - if locality numbers are hard to find on the face of the photo, a rough indication of their position should be given;
specimen number - the field number may follow the style Mu2.08.3, which is a contraction for 1:100 000 area name (eg. Murnaroo) run number, photo number and locality number; personal photograph reference - eg. photo ARM86c1 (ARM's third 1986 film, exposure 1);
RS number of specimen, Departmental numbers for film and photo or frame - added later alongside field numbers where the material has been stored in the Department.

Field note books should be used for extended notes, sketches and general memoranda such as rock specimen and photograph lists, detailed cross-sections and names and addresses of local people. Where significant information is recorded in a note book instead of on the back of an air photo, the air photo should show a reference to the note book and page number. In areas where it is appropriate, detailed stratigraphic sections should be measured by tape, Jacobs staff or on an enlarged air photo. An Abney level is invaluable in measuring Cainozoic sections. Where greater accuracy is required the Surveying Section can make an instrumental survey. Mandelbaum and Sanford (1962) have provided tables for conversion of traverse data to bed thickness.

The following is a check list of some things to note and do at localities of good outcrop (only a few of these may apply at a given point):

topography;
vegetation;
rock type;
total thickness exposed;
rock colour - fresh and weathered (if possible refer to Munsell standard colour chart);
composition of rock;
grain size (medium-grained sand is ¼-½ mm, cobbles are 6-25 cm, medium-grained igneous rock about 1-5 mm, but preferably state actual measured size in mm);
primary structures (note orientation of pillow lavas, ripples, cross-beds, slumps etc for palaeogeographic interpretations);
bed, laminae thickness;
bedding, layering attitude;
joints attitude, spacing, width;
cleavage, schistosity, attitude, character;
vergence, & attitude of minor folds - important in the study of gneissic terrains;
second or further foliations, folds;
photograph;
sketch;
take specimen.

Published maps describe the total geology and thus every opportunity should be taken to note Quaternary rocks as well as the hard rock geology. In Cainozoic geology, contacts and sections should be thoroughly excavated. Surface drift leads to error if only surficial material is observed.

Taking of specimens or photographs should be sufficient for adequate discussion of petrology and illustration of a report. Rock specimens retained for reference purposes are allotted an RS number (based on the 1:100 000 sheet number). The RS number is necessary on any submission form to Amdel, Biostratigraphy or other specialists.

To obtain RS numbers for specimens to be retained, a base map or photo showing their positions should be given to the Map Publication Section. The draftsman will then assign RS numbers and plot them on a key reference map. As soon as sufficient information is known about the specimens (e.g. on receipt of a petrological report) details should be entered on an RS form and given to Computing Services for filing.

Rocks on the RS file need not have been given specialist examination. Some haphazard rock collecting is inevitable during mapping, but it is helpful for filing, rock storage and petrologic interpretation to assemble rocks into logical, ordered groups so that they can be entered into the RS file in a logical order. Such a group would be rocks collected in order from bottom to top of one stratigraphic section on the same 1:100 000 sheet.

Details of photographs worth retaining are entered on a standard form (keywords with comments) and the photographs lodged with Technical Services.

Procedures associated with helicopter geological surveys are described by Krieg (1973).

OFFICE COMPILATION

Concurrently with field work, information from air photos is transferred by the Map Compilation Section to 1:100 000 base maps by optical reduction and progress is discussed with colleagues and supervisors. Although map generalization is unavoidable, the geologist should represent data as objectively as possible.

Choice of map units will be guided by previous local practice, but modifications must be made if they are an advance on previous ideas. The geologist should be familiar with the currently accepted code of stratigraphic nomenclature (see Field Geologists Guide to Lithostratigraphic Nomenclature in Australia). A South Australian stratigraphic lexicon by L. Gerdes (RB 75/100) is available; for the latest information see the Convenor, Stratigraphic Nomenclature, Geological Society. Newly named units must not duplicate old units, must be mappable and have a properly described type section and reference section. Proposed new names must be submitted to the Stratigraphic Nomenclature Subcommittee (S.A. Division of Geological Society) with a condensed description of the unit.

As field work progress thought should be given to the adequacy of specialist data on the map area such as petrology, geochemistry, geochronology, biostratigraphy and geophysical interpretation. Information gained on mineral resources should be assessed and consideration given to test drilling at strategic points.

A set of up to fifty colour slides should be assembled, with written commentary, to form the basis of a geological audiovisual package on the map area. This can be revised and completed at the time of writing of Explanatory Notes.

When field mapping and photo interpretation are completed photographs should be returned to the Compilation Section to finish the transfer of geological detail onto 1:100 000 base maps. It is important that this function be carried out by the Compilation Section as photo scale base maps have generally been replaced by 1:100 000 scale maps and consequently an optical system must be employed to accommodate change of scale.

A dyeline copy of each completed geological compilation is supplied to the geologist for checking and he usually produces a pencil-coloured map to gain an appraisal of the mapping detail. At this stage it is preferable to supply a reduction of the compilation sheet (from 1:100 000 to 1:250 000) to demonstrate the intensity of detail that can be effectively retained at the published scale, although this should have been considered initially by the geologist before field mapping commenced. Using

this system, decisions regarding generalisations and combination of units can be simplified and the preparation of the 1:250 000 drafted sheet should proceed with a minimum of change.

When corrections and amendments have been completed all detail is reduced and added to a 1:250 000 scale base map. Copies are made for checking and a pencil coloured copy may be requested to assist in checking and general assessment. As soon as practicable the geological legend, sections, rock relation diagram, tectonic sketch and other necessary details should be supplied so that the map can be compiled as a complete unit. The map, reference column and accompanying diagrams should be checked by authors, colleagues and Chief Geologist before proceeding to the next stage, colour manuscript. While checking progress of the map, the geologist may continue writing his report on the region.

Discussion may be necessary for colour selection and overprint design, however in most cases standard colours and overprints used on previous standard maps should be adopted to allow continuity between maps. General layout of the colour manuscript may proceed once all exterior details are completed, but it should be remembered that this layout will probably be varied to satisfy the requirements of the published map.

One colour rough should suffice and provided that sufficient pre-planning is carried out, major corrections should not be necessary and the colour copy can be completed promptly and resubmitted to the geologist for a detailed final check.

Approval for publication is required from the Director-General before further work is carried out after the final colour manuscript has been completed.

Map preparation for colour printing is entirely in the hands of the Map Publication Section and the colour manuscript and base map transparency is deemed to be accurate and final for all further processes.

The main steps involved are type listing, map layout, preparation of the type overlay sheet, scribing of topographic and geological details and overprint symbols, preparation of coloured masks for area colour and colour separation of type negatives. After checking, a photomechanical proof (printed

draft) is produced and used to check both geological and cartographic presentation of detail. After checking, all necessary amendments are made to the various components and a composite negative for each colour is produced and used to make the final photomechanical proof and subsequent printing plates.

Printing is carried out by the Government Printing Division and very limited access is available once the composite negatives and photomechanical proof have been submitted.

It is essential that all corrections and amendments are implemented before the composite negatives are completed as NO changes are normally considered once the plating and printing stage has been reached.

REPORT WRITING

General

The format of reports may differ with particular projects but in the normal case of the 1:250 000 Atlas Sheet Series, progress reports should be presented at intervals and a final report on completion. A progress report should be modelled on recently published Explanatory Notes. The final report will be a comprehensive internal report for reference purposes and will be assessed for suitability for publication.

The Editor has provided a style guide which should be followed. When the draft report reaches a supervisor it should be in as final a form as the author can make it.

The author should have corrected any typist's errors. Standard forms of correction are shown in Figure 6. It is also the author's responsibility to check any doubtful points of spelling or grammar himself by using reference works. Handwritten drafts should be written completely in ink and double spaced. It is desirable that the author's original style and ideas be preserved, hence he may expect any proposed alterations to be discussed. Nevertheless, early drafts should be edited by two or three colleagues and critically reviewed by the author before the text commences the approvals round.

Explanatory Notes

The preparation of a manuscript following the format of the Explanatory Notes for the Atlas Sheet Series is the responsibility of the geologist in charge of a mapping project and is the venue for explanation of the mapping units employed and brief descriptions. These notes should be presented promptly and to editorial requirements. They are, as in their name, explanatory notes to the published geological map. Tables of stratigraphic units and summaries of lithology should be broken down into one-page presentations by era or depositional basins such that long lists are avoided.

In all reporting the author must aim to interest his reader, incorporate all relevant information, cull irrelevant data, collate or organise the facts and be consistent. His ideas should be adequately supported by the text of the report and should be concise and unambiguous. Detailed supporting material may be provided as appendices, but photographs and simplified diagrams, sketches and tables may prove more satisfactory. Where possible these should be prepared neatly on A4 format. A Bibliography Index should be prepared.

BGF;WDR:AM

B.G. FORBES

W.D. ROSSINI

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APPENDIX A

List of published geological maps produced by the South Australian Department of Mines and Energy up to December, 1985 (with some projected maps for 1986).

ABMINGA	1:250 000	1985
Adelaide	1:50 000	1980
Adelaide	1:63 360	1951
ADELAIDE	1:250 000	1969
Adelaide Geosyncline and Stuart Shelf	1:600 000	1983
Adelaide region geology & palaeosols	1:250 000	1986
ALBERGA	1:250 000	1959
Alexandrina	1:63 360	1958
Algebuckina	1:63 360	1954
ANDAMOOKA	1:250 000	1965,1982
Angepena	1:63 360	1953
Anna	1:63 360	1955
Arno	1:63 360	1957
Arrowie	1:63 360	1961
Balcanoona	1:63 360	1967
Ballara	1:63 360	1952
BARKER	1:250 000	1962
Beltana	1:63 360	1966
BILLA KALINA	1:250 000	1980
BIRKSGATE	1:250 000	1971
Blinman	1:63 360	1964
Blinman Dome	1:24 000	1963
Boorthanna	1:63 360	1955
Braemar	1:63 360	1961
Burra	1:63 360	1964
BURRA	1:250 000	1964
Cadlareena	1:63 360	1955
Cadnia	1:63 360	1960
Callanna	1:63 360	1963
Chandler	1:63 360	1956
CHILDARA	1:250 000	1977
CHOWILLA	1:250 000	1978
Clare	1:63 360	1964
Conway	1:63 360	1955
COOBER PEDY	1:250 000	1981,1985
Copley	1:63 360	1952
COPLEY	1:250 000	1973
Corunna	1:63 360	1952
Coulta	1:63 360	1958
Cowell	1:63 360	1957
Cultana	1:63 360	1964
Cummins	1:63 360	1958
CURNAMONA	1:250 000	1986
DALHOUSIE	1:250 000	1985
Darke	1:63 360	1957
Davies	1:63 360	1964
Eateringinna	1:50 000	1979
Echunga	1:50 000	1985
Echunga	1:63 360	1954
Encounter	1:63 360	1959
Ernabella	1:63 360	1955
Eudunda	1:63 360	1966

EVERARD	1:250 000		1972
Farina	1:63 360		1956
FOWLER	1:250 000		1975
FROME	1:250 000		1975
Gambier and North-umberland	1:63 360		1951
GAIRDNER	1:250 000		1977
Gardiner	1:63 360		1961
GASON	1:250 000		1973
Gawler	1:63 360		1953
Gawler Craton	1:100 000		1984
Gawler Range Volcanics	1:500 000		1986
Geology of the South East	1:500 000		1980
Giles	1:63 360		1955
Glenorchy	1:63 360		1956
Glynn	1:63 360		1957
Indulkana	1:63 360		1955
INNAMINCKA	1:250 000		1975
Investigator (special)	1:253 440		1961
Jervis	1:63 360		1954
Kalabity	1:63 360		1952
Kapunda	1:63 360		1957
Kenmore	1:50 000		1979
Kiana	1:63 360		1958
KINGSCOTE	1:253 440		1954
Kingston	1:63 360		1951
Kokatara	1:50 000		1979
KOPPERAMANNA	1:50 000		1974
LAKE EYRE	1:250 000		1975
Lincoln	1:63 360		1958
LINCOLN	1:253 440		1958
LINDSAY	1:250 000		1976
Lyndhurst	1:63 360		1956
MAITLAND	1:253 440		1960
Mann	1:63 360		1962
MANN	1:250 000		1962
Mannum	1:63 360		1957
Manunda	1:63 360		1960
Marree	1:63 360		1963
MARREE	1:250 000		1965
McGregor	1:63 360		1952
Middleback	1:63 360		1952
Milang	1:63 360		1960
Mobilong	1:63 360		1960
Moolawatana	1:63 360		1961
Mount Painter Province	1:250 000		1969
MURLOOCOPPIE	1:250 000		1976
Myrtle	1:63 360		1952
NARACOORTE	1:250 000		1969
Neill	1:63 360		1958
Nilpinna	1:63 360		1954
Noarlunga	1:50 000		1982
NOOLYEANA	1:250 000		1973
NUYTS	1:250 000		1986
Olary	1:63 360		1954
Olary Province	1:170 000	approx	1955
Onkaparinga	1:50 000		1979
OODNADATTA	1:250 000		1967
Oraparinna	1:63 360		1965

ORROROO	1:250 000	1968
PANDIE PANDIE	1:250 000	1973
PARACHILNA	1:250 000	1966
Paralana	1:63 360	1961
PEAKE AND DENISON RANGE	1:253 440	1955
Peake & Denison Ranges	1:150 000	1980
PENOLA	1:253 440	1951
PINNAROO	1:250 000	1979
Pinnaroo - Karoonda	1:126 770	1966
Plumbago	1:63 360	1956
POOLOWANNA	1:250 000	1973
PORT AUGUSTA	1:250 000	1969
Quorn	1:63 360	1956
RENMARK	1:250 000	1971
Robe	1:63 360	1951
Roopena	1:63 360	1952
Rudall	1:63 360	1957
Serle	1:63 360	1953
Sleaford	1:63 360	1958
State Map: stratigraphic	1:2 027 520	1953
State Map: structural	1:2 027 520	1953
State Map: geological	1:1 000 000	1980,1983
State Map: geological	1:2 000 000	1982
State Map: tectonic	1:2 000 000	1982
TALLARINGA	1:250 000	1986
TARCOOLA	1:250 000	1985
Tomkinson	1:63 360	1962
TORRENS	1:250 000	1964,1981
Truro	1:63 360	1959
Tumby	1:63 360	1958
Umberatana	1:63 360	1961
Umbum	1:63 360	1955
Verran	1:63 360	1957
Wakefield	1:63 360	1959
Wallaroo	1:63 360	1960
Wangary	1:63 360	1958
WHYALLA	1:250 000	1983
Willochra	1:63 360	1962
Wilpoorinna	1:63 360	1963
Witjuti	1:50 000	1979
WOODROFFE	1:250 000	1967
Yankalilla	1:63 360	1954
Yednalue	1:63 360	1968
Yeelanna	1:63 360	1958
Yorke Peninsula	1:506 880	1961

APPENDIX B
SOME SYMBOLS FOR MAP UNITS

CAINOZOIC

Czcs	COOMB SPRING FORMATION.
Czfe	Iron oxide deposits.
Czh	Blanchetown Clay.
Czm	MILLYERA FORMATION, MOUNT WILLOUGHBY LIMESTONE.
Czp	PEDIRKA FORMATION.
Czsi	Silcrete.
Czw	WILLAWORTINA FORMATION.

QUATERNARY

Qc	COONARBINE FORMATION.
Qfe	Ferruginous gravel, iron oxide.
Qg	Gypseous deposits.
Ql	Playa lake deposits.
Qm	Younger mound spring deposits.
Qs	Simpson Sand; sands of linear dunes.
Qw	WONDILLINA LIMESTONE.

HOLOCENE

Qha	Alluvium.
Qhb	Modern beach sands.
Qhc	COONAMBIDGAL FORMATION.
Qhe	SEMAPHORE SAND.
Qhf	FULHAM SAND.
Qhk	ST KILDA FORMATION
Qhl	Lake and playa deposits.
Qhm	MOLINEAUX SAND; soil covered by thick mulga of NW.
Qhn	Undifferentiated soil mantles; pediment deposits.
Qho	MOORNABA SAND.
Qhp	BUNYIP SAND.
Qhr	Reworked gypsite.
Qhs	Younger sand dunes and overlays.
Qht	High-angle slope deposits.
Qhu	Lunette silts.
Qhv	Basaltic volcanics.
Qhy	YAMBA FORMATION.

PLEISTOCENE

Qp	Transitional sands.
Qpa	Older alluvium of larger streams.
Qpb	BRIDGEWATER FORMATION.
Qpc	COOMANDOOK FORMATION. MT ALICE CONGLOMERATE.
Qpd	DALHOUSIE FORMATION.
Qpe	EURINILLA FORMATION.
Qpf	WOODGATE GRAVEL.
Qpg	GLANVILLE FORMATION.
Qph	HINDMARSH CLAY.
Qpi	TIRARI FORMATION.
Qpj	WIPAJIRI FORMATION.
Qpk	KESWICK CLAY, KATIPIRI SANDS.
Qpl	Ostracod - or gastropod-bearing limestone, including MANGATITJA LIMESTONE; PADTHAWAY FORMATION.
Qpm	MAMPUWORDU SANDS.
Qpn	NILPENA LIMESTONE.
Qpo	WOORINEN FORMATION; WIABUNA FORMATION.
Qpp	POORAKA FORMATION.
Qpr	Gypcrete, BURNHAM LIMESTONE.
Qps	Lunette deposits.
Qpt	TELFORD GRAVEL; high level gravels, ALINERTA GRAVEL.
Qpu	BUNGUNNIA LIMESTONE.
Qpv	Basaltic volcanics.
Qpx	POINT ELLEN FORMATION.
Qpz	ARROWIE FORMATION.
Qlo	LOVEDAY SOIL.
Qsi	Fossil soil opaline material as near base of Blanchetown Clay.

TERTIARY

PLIOCENE

Tpb	BOOKPURNONG BEDS.
Tpc	GIBBON BEDS.
Tpd	DIAPUR SANDSTONE.
Tpe	High level quartz conglomerate, laterized in part.
Tpf	Fresh water gravels and sandstones.
Tph	HALLETT COVE SANDSTONE.
Tpl	LOXTON SANDS.

Tpm	Marine fossiliferous limestones and sandstones.
Tpn	NORWEST BEND FORMATION.
Tpp	PARILLA SAND.
Tpu	ULEY FORMATION.
Tpy	YARDINNA CLAYSTONE.

MIOCENE

Tma	CADELGA LIMESTONE; ALBERGA LIMESTONE.
Tmb	NAMBA FORMATION.
Tmc	CECILIA CONGLOMERATE.
Tmd	ETADUNNA FORMATION.
Tme	MELTON LIMESTONE; GEERA CLAY.
Tmk	MIRACKINA CONGLOMERATE.
Tmm	MORGAN LIMESTONE, PATA LIMESTONE.
Tmn	NULLARBOR LIMESTONE.
Tmp	PORT WILLUNGA FORMATION.
Tmr	PIRRAMIMMA SAND MEMBER of Port Willunga Formation.
Tms	Silicified sands with silcrete pebbles; MOUNT SARAH SANDSTONE.
Tmu	MANNUM FORMATION.

OLIGOCENE

Toc	COMPTON CONGLOMERATE.
Toe	ETTRICK FORMATION.

EOCENE

Teb	BLANCHE POINT FORMATION, BUCCLEUCH BEDS.
Tee	EYRE FORMATION.
Teg	CHINAMAN GULLY FORMATION.
Tek	KNIGHT FORMATION.
Teo	POELPENA FORMATION.
Tep	PIDINGA FORMATION.
Tes	SOUTH MASLIN SANDS.
Tet	TORTACHILLA LIMESTONE.
Tew	WILSON BLUFF FORMATION.
Tp-er	RENMARK BEDS.
Tfe	Laterite, ferricrete.
Tg	GARFORD FORMATION.
Tsi	Silcrete, CORDILLO SILCRETE.
Ts	MOUNT SARAH SANDSTONE.

CRETACEOUS

Ka	MOUNT ALEXANDER SANDSTONE.
Kd	WOOLDRIDGE LIMESTONE MEMBER of the Oodnadatta Formation.
Kel	LOONGANA CONGLOMERATE
Kem	MADURA FORMATION.
Kk	COORIKIANA SANDSTONE.
Klc	CADNA-OWIE FORMATION.
Km	MARREE SUBGROUP.
Kmb	BULLDOG SHALE.
Kmk	COORIKIANA SANDSTONE.
Kml	WILPOORINNA BRECCIA.
Kmo	OODNADATTA FORMATION.
Kn	BLANCHEWATER FORMATION.
Kr	PARABARANA SANDSTONE.
Ks	SHERBROOK GROUP.
Ksb	BELFAST MUDSTONE.
Ksf	FLAXMAN FORMATION.
Ksp	PAARATTE FORMATION.
Kst	TIMBOON SAND MEMBER.
Kuh	MOUNT HOWIE SANDSTONE.
Kw	WINTON FORMATION.
KJm	MONASH FORMATION.

JURASSIC

JKa	ALGEBUCKINA SANDSTONE.
JR	LEIGH CREEK COAL MEASURES.

TRIASSIC

R	NAPPAMERRIE FORMATION.
Rp	PEERA PEERA FORMATION.
Rw	WALKANDI FORMATION.

PERMIAN-MESOZOIC

Pmb	BOONGAR SANDSTONE.

PERMIAN

Pt	MOUNT TOONDINA FORMATION.

?CARBONIFEROUS - PERMIAN

CPb	BOORTHANNA FORMATION.
CPj	CAPE JERVIS BEDS.
CPs	STUART RANGE FORMATION.

CARBONIFEROUS

Cm	MERRIMELIA FORMATION.
Ct	TIRRAWARRA SANDSTONE.
Cw	WAITOONA BEDS.

DEVONIAN

Duc	COOTANOORINA FORMATION.
Dum	MINTABIE BEDS.

ORDOVICIAN

Odb	BUNGADILLINA MONZONITE.
Odg	Delamerian granite. PALMER GRANITE.
Oma	CARTU BEDS.
Omb	BLUE HILLS SANDSTONE.
Omi	INDULKANA SHALE.
Omo	MT. CHANDLER SANDSTONE.
Okv	KULYONG VOLCANICS.
Olm	MUDNAWATANA GRANITE.

CAMBRIAN

Ea	ANDAMOOKA LIMESTONE.
Eb	BILLY CREEK FORMATION.
Ei	WIRRILDAR FORMATION.
Er	AROONA CREEK LIMESTONE.
Eu	URATANNA FORMATION.
Ew	WIRREALPA LIMESTONE.
Ey	YARRAWURTA SHALE.

CAMBRIAN

KANMANTOO GROUP

Eka	BALQUHIDDER FORMATION
Ekb	BRUKUNGA FORMATION.
Ekc	CAMPANA CREEK MEMBER of Ekh.
Ekd	MADIGAN INLET MEMBER of Ekh.
Eke	PETREL COVE FORMATION.

Ekh	CARRICKALINGA HEAD FORMATION.
Eki	INMAN HILL SUBGROUP.
Ekl	TALISKER CALC-SILTSTONE.
Ekm	MILENDELLA LIMESTONE MEMBER of Ekh.
Eko	BLOWHOLE CREEK SILTSTONE MEMBER of Ekh.
Ekr	BACKSTAIRS PASSAGE FORMATION.
Ekt	TAPANAPPA FORMATION.
Eku	TUNKALILLA FORMATION.

LAKE FROME GROUP

Efb	BALCORACANA FORMATION.
Efg	GRINDSTONE RANGE SANDSTONE.
Efm	MOODLATANA FORMATION.
Efp	PANTAPINNA SANDSTONE.

HAWKER GROUP

Ehb	BUNKERS SANDSTONE.
Ehd	MIDWERTA SHALE.
Ew	NEPABUNNA SILTSTONE.
Ehj	AJAX LIMSTONE.
Ehm	MOOROWIE FORMATION.
Ehn	NARINA GREYWACKE.
Eho	ORAPARINNA SHALE.
Ehp	PARACHILNA FORMATION.
Ehr	PARARA LIMESTONE.
Ehw	WILKAWILLINA LIMESTONE.

NORMANVILLE GROUP

Ena	ANGASTON MARBLE.
Enb	BOXING BAY SHALE.
Enc	CORRODGERY FORMATION.
End	COOBOWIE LIMESTONE.
Ene	EMU BAY SHALE.
Enf	FORK TREE LIMESTONE.
Eng	YURUNGA FORMATION.
Enh	HEATHERDALE SHALE.
Eni	WINULTA FORMATION.
Enj	SMITH BAY SHALE.
Enk	KULPARA LIMESTONE.
Enm	MINLATON CONGLOMERATE.

Ɛnn MOONAN FORMATION.
Ɛno STOKES BAY SANDSTONE.
Ɛnr RAMSAY LIMESTONE.
Ɛns SELLICK HILL LIMESTONE.
Ɛnt MOUNT TERRIBLE FORMATION.
Ɛnu KOONUNGA PHOSPHORITE MEMBER.
Ɛnv TRURO VOLCANICS.
Ɛnw WANGKONDA FORMATION.

OTHER UNITS

Ɛmj MT JOHNS CONGLOMERATE.
Ɛmk KALLADEINA FORMATION.
Ɛmo OBSERVATORY HILL BEDS.
Ɛmt TRAINOR HILL SANDSTONE.

WILPENA GROUP

Ɛwa ABC RANGE QUARTZITE.
Ɛwb BUNYEROO FORMATION.
Ɛwc CORRABERRA SANDSTONE MEMBER.
Ɛwe TREGOLANA SHALE MEMBER.
Ɛwh WHYALLA SANDSTONE.
Ɛwi MOORILLAH SILTSTONE.
Ɛwk PUNKERRI SANDSTONE.
Ɛwl MOOLOOLOO SILTSTONE.
Ɛwn NUCCALEENA FORMATION.
Ɛwo ARCOONA QUARTZITE MEMBER.
Ɛwp POUND SUBGROUP.
Ɛwr BRACHINA FORMATION.
Ɛws SIMMENS QUARTZITE MEMBER.
Ɛwt TENT HILL FORMATION.
Ɛwu ULUPA SILTSTONE.
Ɛww WONOKA FORMATION.
Ɛwx YARLOO SHALE.
Ɛwy BAYLEY RANGE SILTSTONE.
Ɛwz BILLY SPRINGS BEDS.

UMBERATANA GROUP

Ɛua WANTAPELLA VOLCANICS.

YERELINA SUBGROUP

Beb	BALPARANA SANDSTONE.
Bec	MT CURTIS TILLITE.
Bef	FORTRESS HILL FORMATION.
Beg	GRAMPUS QUARTZITE.
Bep	PEPUARTA TILLITE.
Beu	GUMBOWIE ARKOSE.

FARINA SUBGROUP

Bfa	AMBEROONA FORMATION.
Bfb	BALCANOONA FORMATION.
Bfc	MT CAERNARVON GREYWACKE MEMBER.
Bfe	ENORAMA SHALE.
Bfh	BRIGHTON LIMESTONE.
Bfk	WAUKARINGA SILTSTONE.
Bfl	THORA DOLOMITE.
Bfo	RODDA BEDS.
Bfr	TARCOWIE SILTSTONE.
Bfru	UROONDA SILTSTONE MEMBER.
Bft	TAPLEY HILL FORMATION.
Bftd	TINDELPINA SHALE MEMBER.
Bfte	EUDUNDA ARKOSE MEMBER.
Bfty	YANKANINNA SILTSTONE MEMBER.

WILLOCHRA SUBGROUP

Bha	ANGEPENA FORMATION.
Bhe	ETINA FORMATION.
Bheu	WUNDOWIE LIMESTONE MEMBER.
Bhew	WEETOOTLA DOLOMITE MEMBER.
Bhl	ELATINA FORMATION.
Bhlr	REYNELLA SILTSTONE MEMBER.
Bhm	MARINO ARKOSE.
Bhw	WILMINGTON FORMATION.
Bhz	TREZONA FORMATION.

UNNAMED SUBGROUP

Bua	APPILA TILLITE.
Bub	CALTHORINNA TILLITE.
Bue	SERLE CONGLOMERATE.
Buh	HANSBOROUGH TILLITE.

Eum MERINJINA TILLITE.
Eus STURT TILLITE.
Euw WILYERPA FORMATION.
Euww WARCOWIE DOLOMITE MEMBER.
Euwb BIBLIANDO TILLITE MEMBER.

YUDNAMUTANA SUBGROUP

Eyb BOLLA BOLLANA TILLITE.
Eyc CHAMBERS BLUFF TILLITE.
Eye BENDA SILTSTONE.
Eyf FITTON FORMATION.
Eyh HOLOWILENA IRONSTONE.
Eyl LYNDHURST FORMATION.
Eyp PUALCO TILLITE.

BURRA GROUP

EMEROO SUBGROUP

Eoa MURRANA BEDS
Eob BUNGAREE QUARTZITE.
Eoc COPLEY QUARTZITE.
Eod WOODNAMOKA PHYLLITE.
Eoe NELSHABY SANDSTONE.
Eof FOUNTAIN SPRING BEDS.
Eoh HUMANITY SEAT FORMATION.
Eoi WILLAWILPA FORMATION.
Eol ALDGATE SANDSTONE.
Eoo OPAMINDA FORMATION.
Eop WORTUPA QUARTZITE.
Eor RHYNIE SANDSTONE.
Eot TOP MOUNT SANDSTONE BEDS.
Eou BLUE MINE CONGLOMERATE.
Eov WIRRABARA FORMATION.
Eow WITCHELINA QUARTZITE.
Eoy YEDNALUE QUARTZITE.

MUNDALLIO SUBGROUP

Emc CASTAMBUL FORMATION.
Emh WOOLSHED FLAT SHALE.
Emhb BALHANNAH SHALE MEMBER.
Emk SKILLOGALEE DOLOMITE.

Pmkn NAPOLEON BRECCIA MEMBER.

Pmm MONTACUTE DOLOMITE.

BELAIR SUBGROUP

Plg GILBERT RANGE QUARTZITE.

Plk KADLUNGA SLATE.

Plm MITCHAM QUARTZITE.

BURRA GROUP

Pba AUBURN DOLOMITE.

Pbar WATERVALE SANDSTONE MEMBER.

Pbal LEASINGHAM QUARTZITE MEMBER.

Pbb BEAUMONT DOLOMITE.

Pbd CRADOCK QUARTZITE.

Pbg WRIGHT HILL FORMATION.

Pbh WOOLSHED FLAT FORMATION, KALACHALPA FORMATION.

Pbi MINTARO SHALE.

Pbm MYRTLE SPRINGS FORMATION.

Pbn NACKARA DOLOMITE.

Pbo GLEN OSMOND SLATE.

Pbp PINDYIN SANDSTONE.

Pbr MINBURRA QUARTZITE

Pbs SADDLEWORTH FORMATION.

Pbsb BETHEL SHALE MEMBER.

Pbu UNDALYA QUARTZITE, STONYFELL QUARTZITE.

RIVER WAKEFIELD SUBGROUP

Prb BENBOURNIE DOLOMITE.

Prc BOCONNOC FORMATION.

Pri INGOMAR QUARTZITE.

Prs STRADBROOKE FORMATION.

Prw WIRREANDA DOLOMITE BEDS.

Pry BLYTH DOLOMITE.

CALLANNA GROUP

ARKAROOLA SUBGROUP

Eab BLACK NOB MARBLE.
Eac CADLAREENA VOLCANICS.
Eai BACKY POINT BEDS.
Eak COOMINAREE DOLOMITE.
Eal WOOLTANA VOLCANICS.
Ean NORANDA VOLCANICS.
Eao YOUNGHUSBAND CONGLOMERATE.
Eap PARALANA QUARTZITE.
Eat CUTANA BEDS.
Eau BOUCAUT VOLCANICS.
Eav BEDA VOLCANICS.
Eay WHYALLA FORMATION.

CURDIMURKA SUBGROUP

Eka ARKABA HILL BEDS.
Ekb BOORLOO SILTSTONE.
Ekc COORANNA FORMATION.
Ekd DOME SANDSTONE.
Ekf DUFF CREEK BEDS.
Ekg RIVER BROUGHTON BEDS.
Ekh HOGAN DOLOMITE.
Eki KIRWAN SILTSTONE.
Ekk ROOK TUFF.
Ekl WAR LOAN BEDS.
Ekm WORUMBA DOLOMITE BEDS.
Ekn NIGGLY GAP BEDS.
Eko ROCKWATER BEDS.
Ekp NILPINNA BEDS.
Ekq WARACO LIMESTONE.
Ekr RECOVERY FORMATION.
Eku DUNNS MINE LIMESTONE.
Ekw WIRRAWILKA BEDS.

PROTEROZOIC BASEMENT

E-r ROOPENA VOLCANICS.
EYa CARPA GRANITE.
EYb BALTA GRANITE.
EYc CHARLESTON GRANITE.

Bγd	WHIDBEY GRANITE.
Bγc	ENGENINA ADAMELLITE.
Bγh	HILTABA SUITE.
Bγk	KIANA GRANITE.
Bγm	MIDDLE CAMP GRANITE.
Bγn	MOUNT NEILL GRANITE PORPHYRY.
Bγo	WATTELOWIE GRANITE.
Bγs	SYMONS GRANITE.
Bγt	TERRAPINNA GRANITE, TICKERA GRANITE.
Bγu	BURKITT GRANITE.
Bγw	WIRRIECURRIE GRANITE.
Bγx	WERTIGO GRANITE.
Bγy	YERILA GRANITE.
Bβ	Basic Intrusives.
Bβd	GAIRDNER DYKE SWARM.
B a	GAWLER RANGE VOLCANICS.
B aa	CARNDING RHYODACITE.
B ac	CHITANILGA VOLCANIC COMPLEX.
B ae	EALBARA RHYOLITE.
B ag	GLYDE HILL VOLCANIC COMPLEX.
B ak	YANDOOLKA RHYOLITE.
B al	LAKE GAIRDNER RHYOLITE.
B an	CHANDABOOKA DACITE.
B ao	KONKABY BASALT.
B ap	PEPEGOONA PORPHYRY.
B au	CULTANA GRANITIC COMPLEX.
B ax	Rhyolite, rhyodacite dykes.
B ay	YARDEA DACITE.
B az	Dacite dykes.
Bb	BAROSSA COMPLEX.
Bc	CORUNNA CONGLOMERATE.
Bcb	BLUE RANGE BEDS.
Bcc	COWLEDS MEMBER.
Bcn	NILGENEE MEMBER.
Bdb	BROADVIEW SCHIST.
Bdd	DOORA SCHIST.
Bdm	MYOLA VOLCANICS. MOONTA PORPHYRY.
Bdw	WARDANG VOLCANICS.
Be	PEAKE METAMORPHICS.

Peb BALTUCOODNA QUARTZITE.
Pet TIDNAMURKUNA VOLCANICS.
Pgg GREENFIELD FORMATION.
Pgm MOONABIE FORMATION.
Pgo OLYMPIC DAM FORMATION.
Pgv MCGREGOR VOLCANICS.
Pgw WANDEARAH METASILTSTONE.
Ph HUTCHISON GROUP.
Phc COOK GAP SCHIST, MANGALO SCHIST.
Phd Basal calc-silicate, WARROW QUARTZITE.
Phk KATUNGA DOLOMITE.
Phm MIDDLEBACK SUBGROUP.
Phm1 LOWER MIDDLEBACK JASPILITE.
Phm2 UPPER MIDDLEBACK JASPILITE, MT SHANNAN IRON FORMATION
Phw WARROW QUARTZITE.
Phy YADNARIE SCHIST.
Pl LINCOLN COMPLEX.
Plc COOLANIE GNEISS.
Pld DONINGTON GRANITOID SUITE.
Plk KALINJALA MYLONITE ZONE.
Plm MINBRIE GNEISS.
Pmm MUSGRAVE-MANN METAMORPHICS.
Pmw WATARU GNEISS.
Pp PANDURRA FORMATION.
Pr RADIUM CREEK METAMORPHICS.
Pra MOUNT ADAMS QUARTZITE.
Prc CORUNDUM CREEK SCHIST MEMBER.
Prf FREELING HEIGHTS QUARTZITE.
Prg YAGDLIN PHYLLITE.
Prr BRINDANA SCHIST.
Pt TARCOOLA FORMATION.
Ptf FABIAN QUARTZITE MEMBER.
Ptp PEELA CONGLOMERATE MEMBER.
Pts SULLIVAN SHALE MEMBER.
Pw WILLYAMA SUPERGROUP.
Pwa Albitic rocks.
Pwe Calc-silicate.
Pwk Upper carbonaceous metapelite.
Pwm Migmatitic gneiss.

ARCHAEAN-PROTEROZOIC BASEMENT

AEm	MULGATHING COMPLEX.
AEm b	Metabasics.
AEmc	CHRISTIE GNEISS.
AEmci	Banded iron formation.
AEmγ	GLENLOTH GRANITE.
AEmk	KENELLA GNEISS.
AEs	SLEAFORD COMPLEX
AEsc	COULTA GRANODIORITE.
AEsg	GREENLY GNEISS.
AEsk	KIANA GRANITE.
AEsn	WANGARY GNEISSES.
AEso	CARNOT GNEISSES.
AEsw	WHIDBEY GRANITE.

APPENDIX C

PAPER WORK AND RELATED PROCEDURES

Authorisation

Transport from office - Principal Geologist; from Depot (longer-term use) - Chief Geologist.

Approval for air travel - Director-General.

Supply Requisitions, up to $200 - Chief Geologist.

Recreation Leave - Chief Geologist.

Diary - Principal Geologist.

Expenses Claim - Chief Geologist.

Locality allowance - Chief Geologist.

Advance Account - Chief Geologist.

Transport Requisition.

For brief use from the office, apply on "Outward transport and material authority" D3. Use for more than a few hours requires "Requisition for transport" C85.
Current debit order is 36G36V01 for Regional Geology Branch. Equipment may need to be listed separately; retain a copy of this.

Vehicle Log

Should be filled in each day. Give the appropriate debit number on each page. If possible, post in completed pages to Transport Officer during a prolonged field trip.

Diary

Saturdays worked in the field should be shown. Before a long field trip diary forms may be entered in advance or may be posted back with expenses claims. For audit purposes hours worked should be entered each day in a diary notebook.

Some debit numbers

36 G 36	F02 air fare
	F03 fuel, oil
	S01 salary
	T02 travel, camping expense
	V01 vehicle hire.

Amdel and other specialist examination:

Application forms are based on RS number. Cards for biostratigraphic work are available. To assist the petrologist or other specialist it may be necessary to supplement the application form with further written or verbal information.

Relevant Amdel reference numbers follow the style below, but may be modified each year.

12.07.00	11	U-Pb dating
	15	KIMBA/ELLISTON
	16	CURDIMURKA
	17	Adelaide region
	18	Coastal Quaternary
	21	BARTON
	22	Lake Eyre region
	23	Radiocarbon dating
	24	LINCOLN
	27	Musgrave Block
	28	Barossa Complex
	29	Officer Basin
	30	Arrowie Basin
	31	Geochemistry of Adelaidean
	32	KINGOONYA
	33	TALLARINGA
	34	Ooldea-Barton ranges
	35	Drilling projects
	37	TARCOOLA
	39	OOLDEA
	40	STREAKY BAY
	41	WARRINA

Some Dockets Relevant to Regional Geology

Adelaide region 1:50 000	211/78
Adelaide region, surficial	547/81
BARTON	248/79
BILLA KALINA	422/62
BMR palaeo. maps	266/84
BMR programme	244/83
BMR South East	670/76
Broken Hill Region	415/69
BURRA	675/76
Cambrian palaeo.	650/79
Chamber of Mines	320/79
CHILDARA	119/73
Clayton-2	99/80
Coastal Quaternary	142/83
COOBER PEDY	812/74
Community Employment Programme	156/84
Core Library samples	396/78, 687/81
Courses, conferences	673/81
Cowell-Mangalo	757/80
CURDIMURKA	252/77
CURNAMONA	669/75
DALHOUSIE	254/81
Drilling	337/76
Employment GE-1	574/74
Students	12/81
Equipment hire	18/81
Eucla Basin	313/74
Eyre Pen. reserves	337/84
Eyre Pen. drilling	152/80
Field Assistants	14/74,115/77
First Aid Kits	771/67
GAB Tertiary	425/73
GAIRDNER	334/72
Gawler Craton strat. & structure	528/81
Gawler Ranges	634/72
Geochemistry, Adelaidean	325/84
Geochronology, U-Pb	206/81
Govt. Geologists Conference	545/81
KINGOONYA	395/72
KOPPERAMANNA	1146/70
Lakes, S.A.	27/83
Lake Eyre Basin	372/77
Lake Eyre Excursion	183/83
Lake Eyre/L. Frome	321/77
Lake Frome	627/81
Landsat purchase	467/76
Late Precambrian correlation	184/77
Map symbols	552/75
Mapping requests from other Depts.	1176/72
Maralinga Lands	SR 5/6/88/1, SR 1/10/2
Muloorina waterwell	175/77
MURLOOCOPPIE	534/75
New building requirements	715/77
Officer Basin	653/78
OLARY	590/68 1302II/71, 182/80

APPENDIX D

MAPPING EQUIPMENT

This is a check list only.

Light geological hammer
Heavy hammer (2-5 kg)
Chisel
Miners pick
Shovel
Mattock
Trowel
Stiff brushes
Square-ended spade
Plastic specimen bags (e.g. 16 cm width and larger)
Pencils (e.g., H, HB)
Red and green wax (eg. Omnichrom) pencils
Pens (eg. 0.18 Rapidograph ISO)
Ball-point pens
Marking pens (e.g. Artline waterproof)
Pencil sharpener
Eraser
Methylated spirits
Dilute hydrochloric acid (10% in acid bottle)
Hand lens (can be conveniently attached to cord)
Pocket knife
Magnet (e.g. pocket pencil magnet with clip)
50 m tape measure
Pocket tape measure
Square protractor
Standard rock colour chart
Brunton compass or equivalent e.g. Silva with spirit level
Field note book
Air photos and extra container
Photo clip board
Base maps
Camera
Accessory lenses
Spare film
Pocket stereoscope
Adhesive tape
Binoculars
Departmental authority card/identity card
Local Order book (emergency purchases and payments)
Safety helmet (worn on engineering sites and in quarries)
Safety glasses
Collecting bag (rucksack, haversack)
Matches
Barley sugar or glucose tablets (an optional emergency ration)
Water bottle
Sunburn cream
Toilet roll
Field geologist's vest
Radio
Tape recorder
Hat
Space blanket (aluminised fabric for emergency cover)

APPENDIX E

SPECIMEN COLLECTION

Rock specimens are collected during geological mapping mainly for visual comparison, thin section petrography and as an office record of rock units. Some other more specialised collections are for geochronology, geochemistry, geophysics and palaeontology.

Early in a mapping project in difficult terrain it is advisable to collect frequently, whereas later it should be possible to be more selective in the choice of specimens. Nevertheless, at all times it is preferable to collect too much rather than too little, since unwanted specimens can be discarded later. The number of specimens collected or finally retained is dependent upon the number of map units covered and the variability of those units. Collection from less accessible areas should be on a generous scale.

In small project areas that are readily accessible it may be preferable to delay systematic rock collection until a preliminary coverage has been made.

Normally the specimen collected should be as little weathered as possible, representative of the outcrop and no larger than necessary to adequately show features of interest. Many sedimentary rock specimens need be no larger than 10 x 7 x 3 cm, but coarse-grained or inhomogeneous rocks may necessitate larger specimens. If there is a possibility that the orientation of the rock could be of future interest, this should be indicated by marking top or bottom of the specimen and a dip and strike on a suitable joint plane. If possible the field number of the specimen should be marked on it. To avoid damage, the specimen should be wrapped preferably in a clear plastic bag into which a numbered metal tag can be stapled as the bag is sealed; the bag itself could also be numbered. An advantage of clear plastic is that it allows inspection of contents; it may, however, suffer damage during rough transport. Careful note needs to be kept of geographic and stratigraphic positions of specimens. Where the location of a specimen is critical, its location should be photographed.

Main requirements of some special kinds of collecting are briefly indicated below. Advice should be sought from the relevant specialists before systematic collection of this nature is undertaken by non-specialists. Contact with the specialist is also advisable during the investigation.

Geochronology (K-Ar, Rb-Sr or U-Pb): for K-Ar and Rb-Sr dating collect about six rock samples from different portions of the same rock mass. Each should be completely unweathered (no ferruginous grain boundaries) and weigh about 2 kg (sufficiently large to extract 3 gm of mica or hornblende). If mica or hornblende content is low a larger sample will be required. Biotite and hornblende must be free of chloritisation which causes loss of argon.

Where dating is by U-Pb determination on zircon a much larger sample, about 20-30 kg, is required.

Geochemistry: the normal precautions should be taken to collect an uncontaminated, fresh and representative sample, of about 20 gm, free of weathered surfaces, with an extra specimen for petrology.

Biostratigraphy: the main requirement is for fresh, uncontaminated material that has been properly located. For microfossil work, about 500 gm are sufficient. In Tertiary carbonate sequences, clayey layers in particular should be sampled. Fragile macrofossils should be carefully wrapped and protected. Potentially large vertebrate remains must generally be left for the specialist to extract after their position has been noted and photographed.

For stromatolite studies large joint blocks of the order of 30 cm cubed (or larger) are needed.

Palynology: near-surface or outcropping rocks are often too weathered to give satisfactory results, but carbonaceous material is worth collecting on the chance that it may contain identifiable plant remains; at least 20 gm of fresh sample are required. In South Australia this applies mainly to Permian and younger rocks. Some carbonate concretions from the Mesozoic contain microfloral material.

Black cherts may yield traces of microscopic organisms and 1 or 2 kg should be collected.

Radiocarbon dating: fossil eggshell and molluscs or gastropods give reliable results. Mollusc/gastropod shell needs to be checked by aragonite/calcite ratios for possibility of replacement. Charcoal is useful, but care must be taken: brown staining may mean replacement by younger humic acid. Record a very detailed field description - there may be infilling of an undercut bank, infiltration down cracks or penetration of roots. Carbonates can be useful and give a minimum age.

Collect with a steel implement into plastic bags.

Quantities: shell - at least one fist-sized mass of solid shell, charcoal- at least a golf-ball size of solid charcoal.

Dates should be duplicated both vertically and horizontally whenever possible.

APPENDIX F

CAMPING, VEHICLE GEAR

As an example, the following equipment is suited to geological mapping by a party of two geologists in outback areas:

Fuel in drums may be needed, pre-delivered.

Two 4WD vehicles (at least one being long-wheel-based)
- 2 Jerrycans drinking water
- First-aid kit
- Fire extinguisher
- Pick
- Shovel
- Axe
- Tool kit with hand tyre pump, 5 tonne hydraulic jack with handle.
- Trouble lamp
- Emergency windscreen
- Extra spare tyre; spare tube
- 1 Jerrycan fuel
- 4 Litres engine oil
- 1 Hand torch
- 1 Toilet roll
- 1 Drinking mug
- 1 Box matches
- 1 Small billy
- 1 Towing cable
- 1 Steel jacking plate
- 4 Planks timber 60 x 5 x 13 cm
- Radio transceiver with whip aerial, for continuous reception.

Additional equipment to be shared between the vehicles.

- 3 kg hammer.
- Brake fluid
- Distilled water
- Transmission oils (gearbox, differentials)
- Rubber tyre hammer, spare tube, 2 large, 2 small tyre gaiters
- Electric tyre pump
- Bull bag (air jack)
- Spare torch batteries
- 1 funnel for water
- 1 siphoning hose for fuel
- 1 siphoning hose for water
- 1 set jumper leads for starting vehicle on flat battery
- 4 sugar bags
- Rubbish bags
- 300 plastic sample bags
- Epoxy resin repair kit eg. "Plastibond", "Araldite"
- Small refrigerator

Possible other requirements

Trailer with spare wheel, wheel-brace
Extra Jerrycans water, fuel
Fuel drum opener, pump, measuring stick
One caravan with normal accessories
Spare tyre for caravan; tube and wheel brace
Mattresses, pillow and covers for 2 people in caravan
Personal bedding
1 broom
1 mop) or self-squeezing mop
1 mop bucket)
2 plastic buckets
2 plastic washup bowls
Toilet rolls
Cooking and eating equipment including saucepans, teapot, fry pan, dinner plates, soup plates, mugs, cutlery, bread knife, potato peeler, butchers knife, vegetable knife, egg slice, dish mop, tin openers, egg beater.
Barbeque hot plate
Matches
Washing powder
Velvet soap, solvol soap
Steel wool
Rags
Detergent
Detergent hand cream
3 dozen clothes pegs
Clothes line
1 portable camp shower
Fly spray
Camp tables, chairs
Air conditioner, generator

Gear and spare parts for vehicles are listed below but the Transport Officer should be consulted (or responsibility given to an accompanying driver/mechanic) before ordering.

EQUIPMENT FOR FIELD TRIPS
(This is a check list only)

Fuel pump
Drum measurer
Drum opener
Special spanners (for hub nuts etc.)
Hand winch and handle
Steel pegs
Sledge hammer

Brake fluid
Distilled water

Engine oil
Methylated spirits

Sample bags - small linen
large linen
small plastic
large plastic

Sugar bags
Old super bags (packing)
Water bottles (in boxes)
Water bottle labels

Soap - solvol
velet

Gas cylinder
Fuel

Dish mop
Dish cloth

Hand cleaner
Globes - 240 v
32 v
12 v
Gas mantles
Matches
Fly spray
Fly repellant
Spare torch batteries
Spare torch globes
Toilet rolls
Aluminium tags
Tape - masking
durex
yellow, red,
plastic
Rags
Clothesline and pegs
Paper towels
Aluminium foil
Plastic wash bowels
- large
small
Buckets (Plastic)
Shower bucket (with ropes and pulleys)
Jerry cans - water, fuel
Syphon hose - water, fuel
Plastic funnels - water, fuel
Mop bucket
Mop
Water bag - small, or camp size
Water bottle
Gas cooker
Gas lamp
Camp oven
Griller
Meat saw
Gas lighter
Sponge material for packing
Tent
Pack rack
Rope
Camp table
Camp chairs
Rubbish bin
Ground sheet

Tarpaulin
Tent pegs

Detergent
Ajax Cleaner (for stoves etc.)
Billies
Kettle
Teapot
Mixing bowls
Broom
Butter dish
Bread board
Colander
Cups and saucers
Enamel pie dish
Plastic dishes
Fire extinguisher
Egg slice
Egg beater
Enamel mugs
Carving fork
Dinner fork
First Aid kit
Fry pan - large
small
Bread knife
Butchers knife
Carving knife
Dinner knife
Pillows
Pillow slip
Enamel plates (deep)
Dinner plates
Small plates
Soup plates
Saucepans
Dessert spoons
Tea spoons
Sharpening steel
Salt shaker
Pepper shaker
Tin opener (cork screw)
Toaster
Tea towels
Vegetable peeler
Willow Roaster
Willow Boiler
Ladle
Meat bag

Head lamp bulbs
Trafficator bulbs
Rear light bulbs
Spare globe for trouble lamp

<u>Mechanical kit and miscellaneous gear</u>

Tent poles
Mattresses
Stretchers
Sleeping bags
Pillows, covers

Blankets
Torch
Extension leads
(a) battery to battery
(b) battery to van lights

U bolt for caravan
Spare wheel, caravan
Wheelbraces for caravan
Jacking plates
Jacking boards
Pick
Shovel
Axe
Saw
Tool kit to suit vehicle
Towing cable
Spare hydraulic jack
Refrigerator
Haversack
Insect spray
(Much of this equipment is included in normal list for caravans).

SPARE PARTS REQUIRED FOR VEHICLES (depending on type of trip : check with workshop)

Electrical
(N.B. Some vehicles are 24 v)
Distributor points
Condensor
Coil
Set of spark plugs
Packet of fuses

Extra tools possibly required

Hacksaw plus blades
Soldering iron, solder (resin cored) and flux
Multigrip pliers
Long nosed pliers
Feeler gauge
Rubber hammer
Wire brush
Centre punch
Phillipshead screwdrivers
2 crescent spanners - large and small
Multipurpose wheel brace

Spare radiator, heater hoses
Hose clamps
Fan belt
Barsleaks (for radiator holes)
Plastic hose (clear)
Grease gun and grease
Spare tubes, spare wheel
Epoxy resin repair kit (e.g. Plastibond, Bostik, Araldite)
Workshop manual
Bead breaker
Box of assorted nuts, bolts, self tapping screws wheel nuts etc.
Spare dry 12 v battery and acid (in kit)
Spare patches
Spare filters (on fuel line - IMPORTANT)

Sauce : mint
worcestershire
tomato
soy
horse raddish
Mustard
Curry
Gravox

Lunch-wrap paper
Alfoil
Gladwrap

Tinned fish : tuna
sardines
salmon
herring

Tinned: soups
beetroot
potato salad
sauerkraut
vegetable salad
asparagus
sweet corn
fruit
mushrooms
rice cream
puddings
spaghetti
baked beans

Gasket goo
Socket set including plug spanner
Set of AF, SAE a/o metric spanners
Allen keys
Ordinary screwdrivers
Files : including points file
Small hammer
Small mirror on flexible arm

APPENDIX G

FOOD CHECK LIST

Bread
Rolls
Biscuits : dry
sweet
Cake
Buns
Flour : plain
S.R.
cornflour
Rice
Spaghetti
Breakfast cerals, muesli
Beef : steak, roast
corned beef
Lamb : (vacuum-sealed meat
chops is advantageous on
roast long trips)
Pork
Poultry
Sausages
Eggs
Bacon
Salami
Mettwurst
Cabanas
Polish sausage
Meats: tinned
Butter
Margarine
Cooking oil
Cooking fat
Milk : powdered
evaporated
condensed
long-life
Cream tinned, long-life
Cheese
Vegemite
Peanut paste
Fish paste
Jam
Honey
Golden syrup
Salt, pepper
Sugar
Tea
Coffee
Cocoa
Milo
Sal vital
Cordials
Limejuice
Fruit juices

Potatoes
Onions
Carrots
Tomatoes
Beans
Peas
Sweet corn
Cabbage
Brussels sprouts
Cauliflower
Parsnips
Swedes
Pumpkin
Trombone
Beetroot
Capsicums
Celery
Parsley
Cucumber
Radish
Lettuce
Vegetables : dried
tinned
Apples
Oranges
Mandarins
Bananas
Lemons
Coconuts
Grape-fruit
Pineapple
Apricots
Peaches
Plums
Dried fruits
Nuts

Packets : soups
instant meals
mashed potato
ice cream mix

Herbs
Vinegar
Pickles: mustard
onions
gherkins
Peppers
HP
Mayonnaise
Olives

APPENDIX H

SAFETY

Important points are maintenance of communication, locally and with head office, and carrying of adequate supplies (especially food, water and fuel) and a suitable first aid kit. Hard hats, safety boots and safety glasses should be used where appropriate.

In the event of injury, immediate help should be sought after ensuring that the patient's breathing is not obstructed and he/she is in a suitable position. Artificial respiration may have to be applied. Unnecessary movement of the patient should be avoided while as much as possible is learnt of the nature of the injury and relevant personal details of the patient such as name, age and medical history.

Burns can be effectively alleviated by immediate immersion in cold water. In the event of snake bite, the bite should be washed and the patient kept quiet while help is sought. If possible a pad should be placed over the wound and the affected limb firmly and completely bandaged.

Frequent exposure to the sun during field work can induce skin cancer, hence it is wise to wear a hat and make use of an effective filter lotion on the skin: hands and face are the most likely areas to suffer.

Absalom (1976) provides much good advice for outback travellers. Dunlevy (1978) advises on techniques for survival in emergency.

APPENDIX I

THE SA DEPARTMENT OF MINES AND ENERGY LIBRARY
(by J.A. Hutley)

The Department maintains one of the best collections of Energy Policy, Mining and Earth Science literature in Australia. Our coverage is increased by a policy of cooperation with the Australian Mineral Foundation's library. This co-operation is the basis of the Australian Earth Sciences Database (AESIS) run by the AMF. Therefore, any AESIS reference is directly available from us, or via courier from AMF's library. The two libraries also share a joint microfiche catalogue since 1985.

Space problems (1986) do not permit the library to be housed on one site, therefore the collection has been split:

(a) 'Main Library'; 12-14 Glen Osmond Road.

The main book and journal collection in the Earth Sciences and Mining. This site houses the Library Office and the Current Display.

(b) 'Biostratigraphy' and 'Energy Libraries'; 5th Floor Head Office.
Specialist collections of journals/books in Energy Policy and Palaeontology, and

(c) Glenside Annex by AMF

Backruns of journals available on 24 hour call by courier.

All library items are linked through the SADME/AMF microfiche catalogue.

Departmental staff can freely borrow from the holdings of the Departmental and AMF libraries. Where necessary, material can be borrowed from any library in Australia.

All new material is displayed for two weeks and staff are expected to scan this new literature. New material is circulated for five working days and the borrower's name can be added automatically to new issues of a particular title.

Research assistance is available through the Reference Collection and through the production of bibliographies. The library has access to Australian and overseas databases via its own terminal and these online services are now standard research tools.

Finally, the library staff welcomes all new members of staff to pay a visit and discuss their particular research needs.

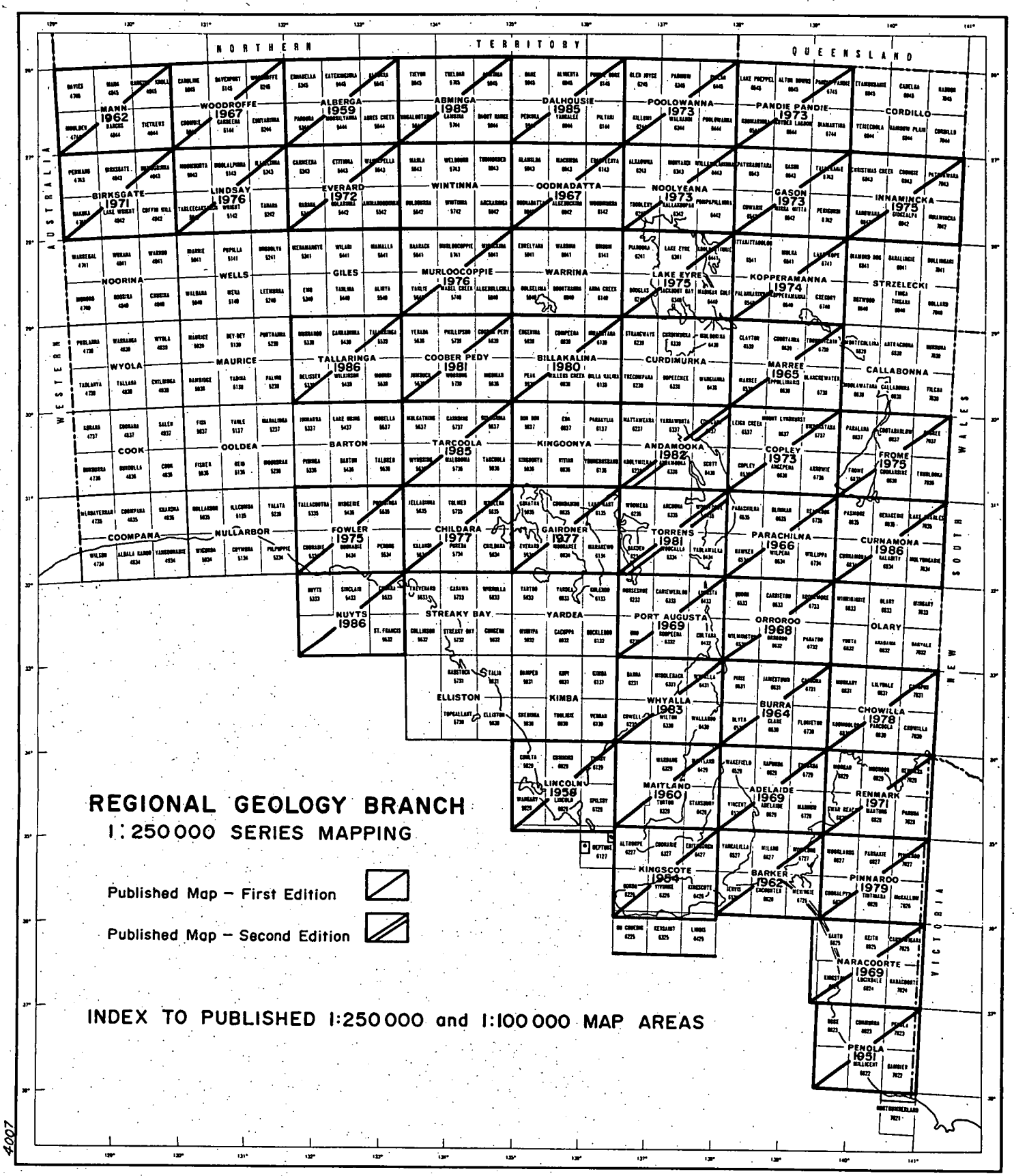

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FIG. 1

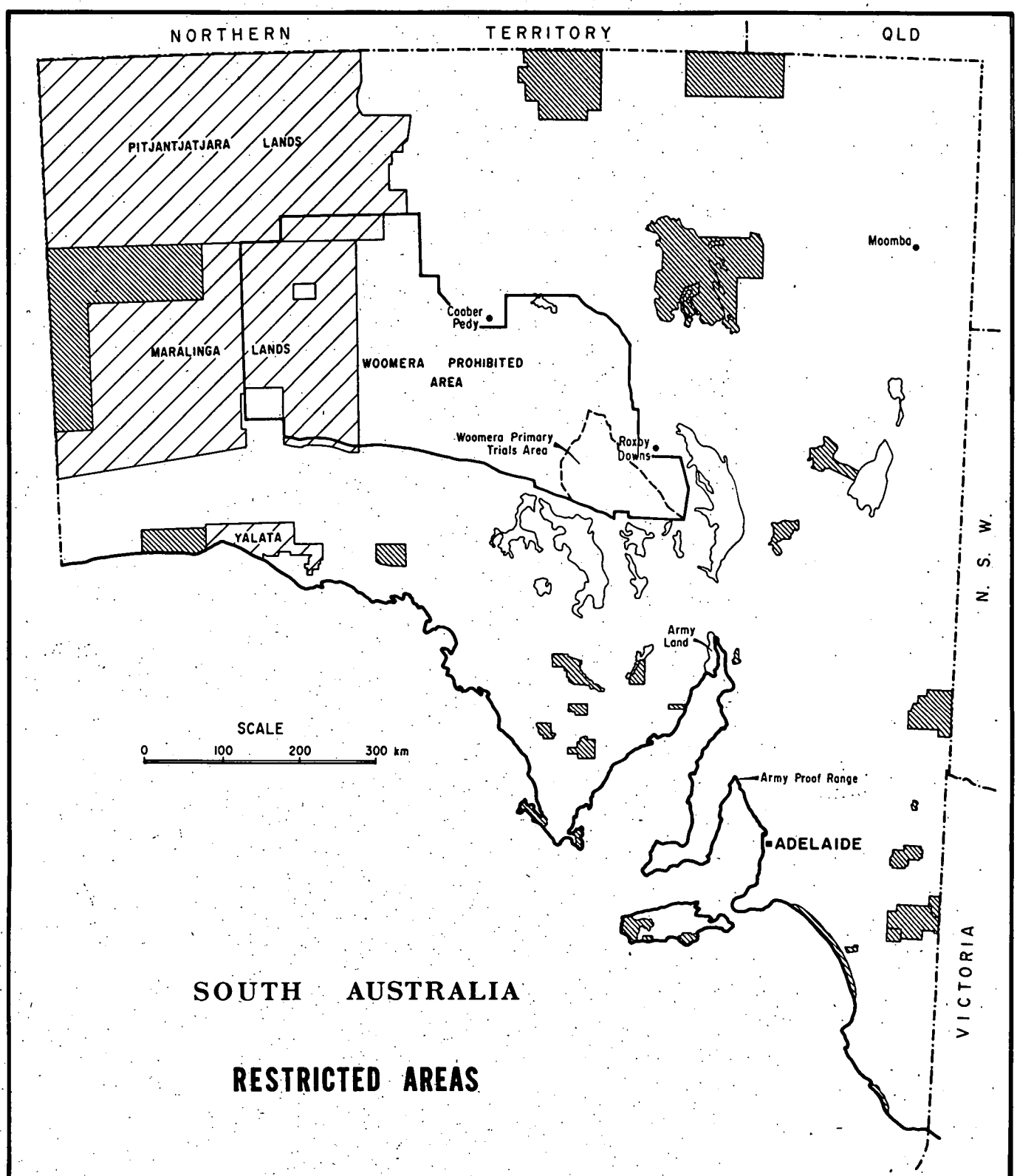

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FIG. 2

4007

SOME COMMON SYMBOLS FOR USE ON AIR PHOTOS

Where symbols obscure too much detail a locality reference number may be used instead and the information recorded on the back of the photo.

LITHOLOGICAL

- Conglomerate ..... co
- Sedimentary breccia or tillite ..... co
- Sandstone ..... ss
- Shale ..... sh
- Siltstone ..... sis
- Dolomite ..... dol
- Limestone ..... ls
- Calcitic siltstone .....
- Schist ..... sch
- Gneiss ..... gn
- Granite ..... g
- Crushed rock .....
- Basic volcanics .....
- Acid volcanics .....
- Silcrete ..... si
- Calcrete ..... ca
- Ironstone ..... fe
- Quartz ..... qz, z
- Gypsum ..... gy, y
- Red sand/sandy soil ..... s
- White sand ..... sw
- Slope gravels, thick gibbers; e.g. on Pooraka Formation .....
- Creek alluvium .....
- Higher level gravels e.g. Telford Gravel ..... p
- Quartz gravel ..... z
- Ironstone gravel ..... fe

STRUCTURAL

- Bedding: dip/bearing 080/50
- " : vertical, horizontal .....
- Flow banding .....
- Metamorphic foliation 135/70
- Cleavage dip 170/70
- Vertical cleavage 030
- Top of bed: sedimentary/volcanic .....
- " : structural .....
- Plunge of lineation or fold: amount/direction 20/240
- Locality reference number 6
- Section line .....

CULTURAL

- Main sealed road i
- Main unsealed road ii
- Tracks iii
- Poor tracks, not recommended for final map iv
- Fence .....
- Gate .....
- Bore .....
- Well .....
- Water tank ..... T
- Earth tank ..... E
- Ruin ..... R
- Mine .....
- Quarry .....

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FIG. 3

4007

PREFERRED LETTERING STYLE

Single-stroke inclined caps and lower case.

The snap and swing of professional work are due to three things: first, to keeping to a uniform slope; second, to having the letters full and well shaped; and third, to keeping them close together.

FIG. 4

EXAMPLE OF PHOTO MARKING

FRONT:

Recommended margin for marking up

BACK:

WANGIANNA 1:100 000 Survey 1074 Run 6 Photo 021 Scale 1:88 000

A.G. Smith 10.6.86 ① qte. feldspathic, med-gr. beds 10-50 cms, 20 cm x-bed units show facing NE'ly, current → N'ly ? Subvert, S 140°. 6438 RS 75 roll 408: 65124, 5. spec [Wa 6.21.1] photos AGS.c 10, 11. To E. & W, siltst. green-grey, flaggy, lam. Sparse saltbush on low ridges.

② 5 m. cliff : top ~ 50 cm. gravel of rounded qte, qz, siltst. clasts 3-15 cm on 1 m. brownish pebbly x-b co. ss, 1·5 m covered, 2 m creek bank. ? Bulldog Sh. - dk greyish mudstone [Wa 6.21.2] RS 76 with one reddish porphyry boulder [Wa 6.21.2a] 6438 RS 77 roll 408; 65126-8 50 cm. photos AGS.c 12-15. Upper gravel unit (? Telford) extends sporadically to dam.

③ Ruins of Aynsley Outstation, flagstone. qz gravels, frags. up to 5 cm nearby netting fence. Dam ~ ½ full 11·6·86

GEOLOGICAL SURVEY SOUTH AUSTRALIA

S.A.D.M.E. Plan No. S18524

FIG. 5

4007

SYMBOLS FOR CORRECTING PROOFS

No.	Instruction	Textual mark	Marginal mark*
1	Correction is concluded	None	/
2	Insert in text the matter indicated in margin	⋏	*New matter followed by* /
3	Delete	Strike through characters to be deleted	δ/
4	Delete and close up	⁀ above and ‿ below letters to be taken out	⁀δ‿
5	Leave as printed	. . . . under characters to remain	*stet*
6	Change to italic	——— under characters to be altered	*ital*
7	Change to even small capitals	═══ under characters to be altered	*s.c.*
8	Change to capital letters	═══ under characters to be altered	*caps*
9	Use capital letters for initial letters and small capitals for rest of words	═══ under initial letters and ═══ under the rest of the words	*c.& s.c.*
10	Change to bold type	~~~~ under characters to be altered	*bold*
11	Change to lower case	Encircle characters to be altered	*l.c.*
12	Change to roman type	Encircle characters to be altered	*rom.*
13	Wrong font. Replace by letter of correct font	Encircle character to be altered	*w.f.*
14	Invert type	Encircle character to be altered	ϙ
15	Change damaged character(s)	Encircle character(s) to be altered	x
16	Substitute or insert character(s) under which this mark is placed, in 'superior' position	/ through character or ⋏ where required	⋎ *under character* (e.g. ⋎ʸ)
17	Substitute or insert character(s) over which this mark is placed, in 'inferior' position	/ through character or ⋏ where required	⋏ *over character* (e.g. ˣ⋏)
18	Underline word or words	——— under words affected	*underline*
19	Use ligature (e.g. ffi) or diphthong (e.g. œ)	⁀ enclosing letters to be altered	⁀ *enclosing ligature or diphthong required*
20	Substitute separate letters for ligature or diphthong	/ through ligature or diphthong to be altered	*write out separate letters followed by* /
21	Close up—delete space between characters	⁀ linking characters	⁀
22	Insert space†	⋏	#
23	Insert space between lines or paragraphs†	> between lines to be spaced	#
24	Reduce space between lines†	( ) connecting lines to be closed up	*less # or close up*
25	Make space appear equal between words	| between words	*eq. #*
26	Reduce space between words†	| between words	*less #*
27	Add space between letters†	' ' ' ' between tops of letters requiring space	*letter #*
28	Transpose	⌐⌙ between characters or words	*trs*
29	Place in centre of line	Indicate position with ⌈ ⌉	*centre*

* Words printed in italics in column below are instructions and not part of the marks.
† Amount of space may be indicated.

No.	Instruction	Textual mark	Marginal mark
30	Indent one em	⊏	□
31	Indent two ems	⊑	□□
32	Move matter to right	⊏ at left or right side of group to be moved	⊏
33	Move matter to left	⊐ at right or left side of group to be moved	⊐
34	Move matter to position indicated	[ ] at limits of required position	*move*
35	Take over character(s) or line to next line, column or page	⊏	*take over*
36	Take back character(s) or line to previous line, column or page	⊐	*take back*
37	Raise lines	⊤ over lines to be moved ⌐¬ under lines to be moved	*raise*
38	Lower lines	⌐¬ over lines to be moved ⊥ under lines to be moved	*lower*
39	Correct the vertical alignment	‖	‖
40	Straighten lines	═══ through lines to be straightened	═══
41	Push down space	Encircle space affected	⊥
42	Begin a new paragraph	⊏ before first word of new paragraph	*n.p.*
43	No fresh paragraph here	⌒ between paragraphs	*run on*
44	Spell out abbreviation or figure in full	Encircle words or figures to be altered	*spell out*
45	Insert omitted portion of copy	⋏	*out - see copy*
46	Substitute or insert comma	/ or ⋏ through character where required	,/
47	Substitute or insert semicolon	/ or ⋏ through character where required	;/
48	Substitute or insert full stop	/ or ⋏ through character where required	⊙
49	Substitute or insert colon	/ or ⋏ through character where required	⊙
50	Substitute or insert question mark	/ or ⋏ through character where required	?/
51	Substitute or insert exclamation mark	/ or ⋏ through character where required	!/
52	Insert parentheses	⋏ or ⋏⋏	(/)/
53	Insert brackets	⋏ or ⋏⋏	[/]/
54	Insert hyphen	⋏	|-|
55	Insert en (half-em) rule	⋏	⊓
56	Insert one-em rule	⋏	⊓
57	Insert two-em rule	⋏	2em
58	Insert apostrophe	⋏	⁾/
59	Insert single quotation marks	⋏ or ⋏⋏	⁾/ ⁾/
60	Insert double quotation marks	⋏ or ⋏⋏	⁾⁾/ ⁾⁾/
61	Insert ellipsis	⋏	.../
62	Insert leader	⋏	⊙
63	Insert diagonal stroke	⋏	⊘
64	Refer to appropriate authority anything of doubtful accuracy	Encircle words etc., affected	⊘

FIG. 6

S.A.D.M.E. Plan No. S18525

4007