COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

AN ACCOUNT OF THE METHODS OF DOCUMENTATION OF THE CORES, CUTTINGS AND OTHER SAMPLES COLLECTED IN DRILLING OPERATIONS

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TITLE: AN ACCOUNT OF THE METHODS OF DOCUMENTATION OF THE CORES, CUTTINGS AND OTHER SAMPLES COLLECTED IN DRILLING OPERATIONS

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Bureau of Mineral Resources Geology and Geophysics.

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SUMMARY.

The Bureau of Mineral Resources, Geology and Geophysics, has established the Core and Cuttings Laboratory to handle the storage of subsurface samples collected from the sedimentary basins of Australia and its Territories. This paper describes in detail the methods of documentation adopted by the Laboratory to record adequately all the samples and also the relevant data.

INTRODUCTION

The discovery of oil in commercial quantities at Moonie, Queensland, in 1961 caused a sudden increase in the pace of geological exploration and drilling for oil in Australia. Additional drilling, improved techniques and more thorough testing of each well have considerably increased the volume of well data. As a result, the Core and Cuttings Laboratory has evolved a system of data storage and retrieval, primarily to suit its own needs, but which can also supply fundamental data to other Branches of the Bureau, or to outside organizations as required.

In this system, indexing of data relating to the samples held by the Laboratory is integrated with drilling and general exploration data. These two aspects of the data storage and retrieval system will be described separately.

PART 1

SAMPLE STORAGE, INDEXING AND RECORDING OF RELEVANT INFORMATION

1. TYPES AND SOURCES OF SAMPLES

The Core and Cuttings Laboratory is responsible for the storage of all subsurface samples obtained by the Bureau of Mineral Resources from the sedimentary basins of Australia and its Territories. This material may be from drilling by private enterprise or by government agencies.

Subsurface material from Commonwealth drilling operations is automatically sent to the Laboratory for storage and indexing. The main reason for the considerable amount of subsurface material arriving from private enterprise is the Petroleum Search Subsidy Act 1959-1964. Under this Act, if a private company wishes to qualify for financial assistance from the Federal Government in drilling or geophysical survey work directed towards the search for oil, it must supply a detailed programme of the work to be undertaken, and must share with the Bureau the geological and technical information gained from that operation. In the case of drilling operations, the subsidized company must send 1/6th of the total drill core recovered, one sidewall core from every six recovered, and a sample of drill cuttings from every 10 feet, except in special cases.

A substantial amount of subsurface material is also received from unsubsidized drilling operations - structural, stratigraphic and seismic bores, wildcat oil wells, water bores, etc; in most cases the

submission of material has been a matter of co-operation. In addition, the Bureau offers specialized services to outside organizations under certain conditions, and will carry out palaeontological and radioactive age determinations, petrophysical analyses and petrological examinations on the company's material if this is to the mutual benefit of both parties; surplus material, together with residues or concentrates are retained by the Laboratory.

2. METHODS OF STORING SAMPLES

The actual storage of all drill cores, sidewall cores and drill cuttings from a particular well is quite straightforward, as it is entirely based upon the Well Index Number. Each well represented in the collection is allocated a Well Index Number which is the accession number and the key to the entire collection. The well samples are stored in order of their index numbers, and therefore there is no need to identify aisles, bays or shelves, nor to keep a cumbersome cross reference system to find the various storage locations of the materials from a particular well. Drill cores from each well are stored first in order (starting at the highest core) and are followed by the sidewall cores and drill cuttings also in order; thus, all the samples are housed in a different area of the store, but in precisely the same manner - except that the key to this collection is the Seismic Survey Index Number and not the Well Index Number.

The samples arriving at the Laboratory are registered and are stored as soon as possible. Before this, however, the parcels of samples must be checked against the covering letters, and must be packed into

the standard Laboratory containers. The various methods adopted for handling samples can best be considered in terms of the types of material handled:

drill cores

sidewall cores

drill cuttings

seismic shothole samples

representative washed cuttings and specialist material

fluid samples

The type of content of any laboratory container is immediately apparent because of the standard colour coding used in all phases of storage:

drill cores - white

sidewall cores - green

drill cuttings - pink

seismic shothole samples - blue

(a) Drill Cores

Drill cores are marked with insoluble, quick drying ink. If the core is competent, the markings go directly onto the samples; if the core is friable or lighologically incompetent, it is placed in polythene tubing of an appropriate size and all markings are written on the tube.

(i) Discontinuous core samples. In most cases, four-inch long pieces are selected from every two feet of core recovered during subsidized drilling operations for submission to the Core and Cuttings Laboratory. Such samples are marked at the Laboratory

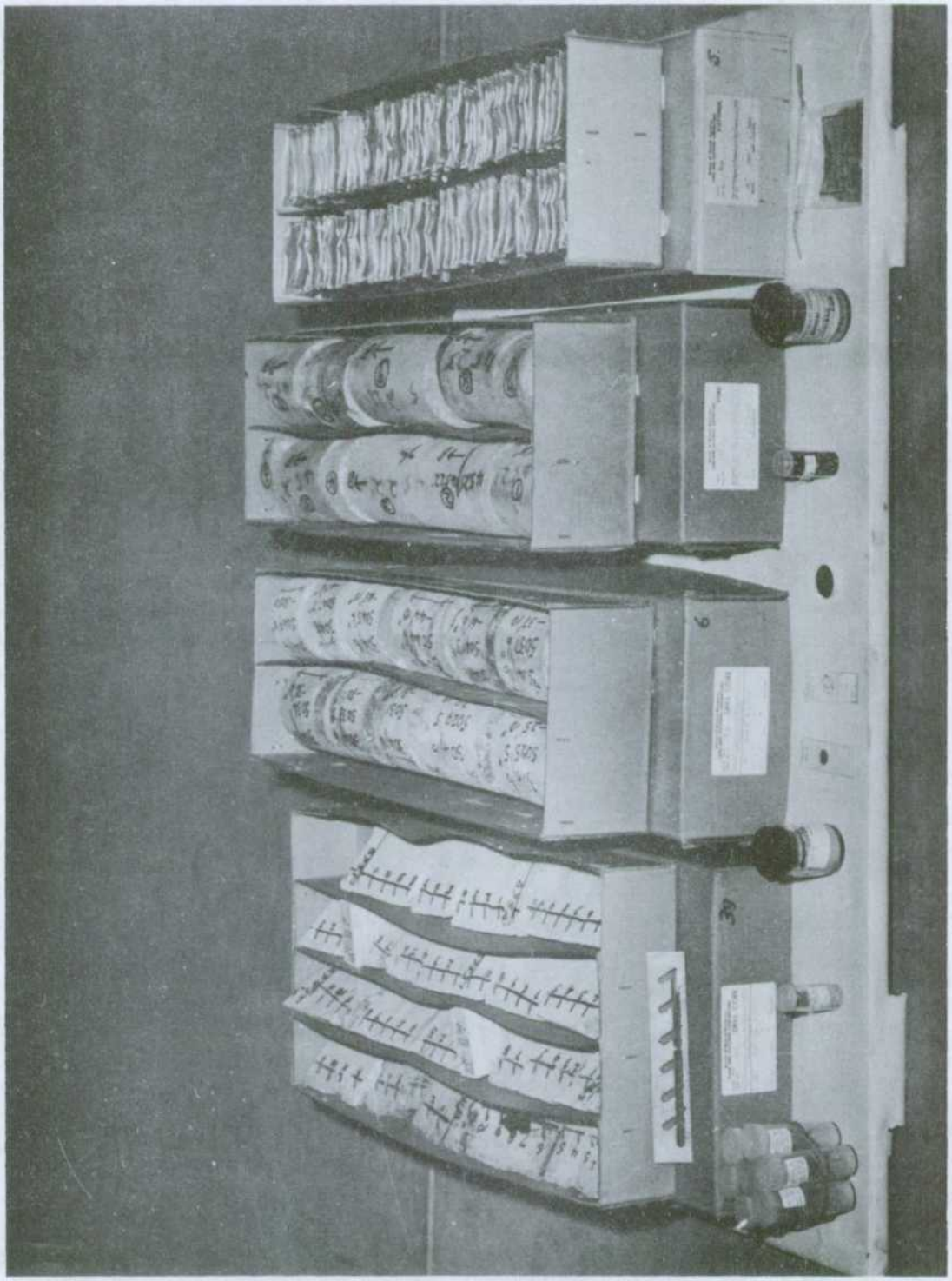

Figure 1. Examples of labelling and packing core and cuttings, and related specialist material. (Each box 24 inches long).

with the following information supplied by the company: core number, depth interval, and an arrow pointing towards the lower end to orientate each sample. In addition, the Well Index Number is marked on each sample because this number is the basis of storage for all material from that particular well (see Section 3).

(ii) Continuous core samples. The Laboratory may receive the total length of the recovered core or a sliced portion of it. In both cases it is treated as a continuous core. If the core has been marked by the company with only occasional depth markings, the Laboratory numbers each sample in order to preserve the sequence of the core, always starting with the uppermost sample. However, if the recovery is close to 100% or if the cause for the loss of the core is known and therefore accounted for; footage marks are stencilled on the core.

The stencil used, and an example of the different types of markings is shown in Fig. 1. The stencil is made of thin steel, and it combines the functions of the arrow and of the footage mark (the distance between adjacent "half arrows" is one inch). This means that, should the core be broken up into pieces as small as one inch in length in the course of examination, re-marking of it is not necessary to preserve the accurate depth markings. If later the core is slabbed, or thin sections are cut from it, care must be exercised to ensure that the stencilling is not destroyed.

It has been found necessary to use these different types of markings to cater for the varying degree of accuracy of depths available for the cores. The following points are considered before the method of

core marking is decided upon:

(i) Where the recovery of core from a particular interval is not 100%, several explanations could be given for the loss of core:

- inefficient operation of the core catcher;
- a thin layer of friable, water susceptible or soft lithology occuring between harder layers;
  (clay, shale, coal, etc.)
- clogging of inner core barrel;
- friction between rotating core pieces

As the last three can occur anywhere within the cored interval, only the Wellsite Geologist should attempt to decide on the reasons for the core loss, and only he can put definite depths on core samples - and then only if the recovery warrants such a step. Markings of depths on cores - without knowing the reasons for the loss of core - would be misleading. Therefore, when core samples are received at the Laboratory without precise depth markings, the staff determine the possible error and mark it on the core in the following manner:

" $\pm$ . . . feet/inches".

During transportation from the wellsite to the Laboratory, depth markings on cores can be rubbed off, and the orientation and the order of the individual pieces can be disturbed. In most cases the limits of such error can be determined on arrival at the Laboratory, and the cores can be marked to incorporate such errors.

As only determinable depths are marked with footages, these different types of marking put the designated core depths into their

Figure 2. Heavy duty racks with adjustable shelves used throughout the store.
(Each bay 95" x 25" x 24").

proper perspective regarding accuracy. Where there are doubts about the correct depth interval, only the drilled interval, sequence of pieces, and limits of maximum error are shown.

The marked cores are stored in cardboard cartons, with outside fitting lids. All cartons are 2 feet long but differing in width and height to cater for the general sizes of core being handled. The cartons are stored in steel shelving illustrated in Fig. 2, and the carton widths of 6, 8 and 12 inches make maximum use of the shelf width of 24 inches; the 6, 4, 3 and 2-inch height of the cartons fully utilizes the adjustable shelfing, which can be fitted at inch spacings. For illustrations of cartons and the shelving see Figs. 1 and 2. The pressure sensitive labels used on the core boxes and lids are coloured white - in accordance with the colour code - and are illustrated in Fig. 3 (a).

(b) Sidewall Cores.

These cores are stored in glass bottles with bakelite screw-on-tops, and with the identification marked on the frosted face of the glass. The bottles lie on their sides - labels uppermost - in the four channel boxes. The boxes are identified by their green labels, see Fig. 3 (b). The boxes containing sidewall cores are stored together with boxes of drill cores and drill cuttings from the same well - all of which bear the same Well Index Number.

(c) Drill Cuttings

Cuttings are stored in polythene bags, shown in Fig. 1. The printing block on the bags is specified at the time of purchase. To

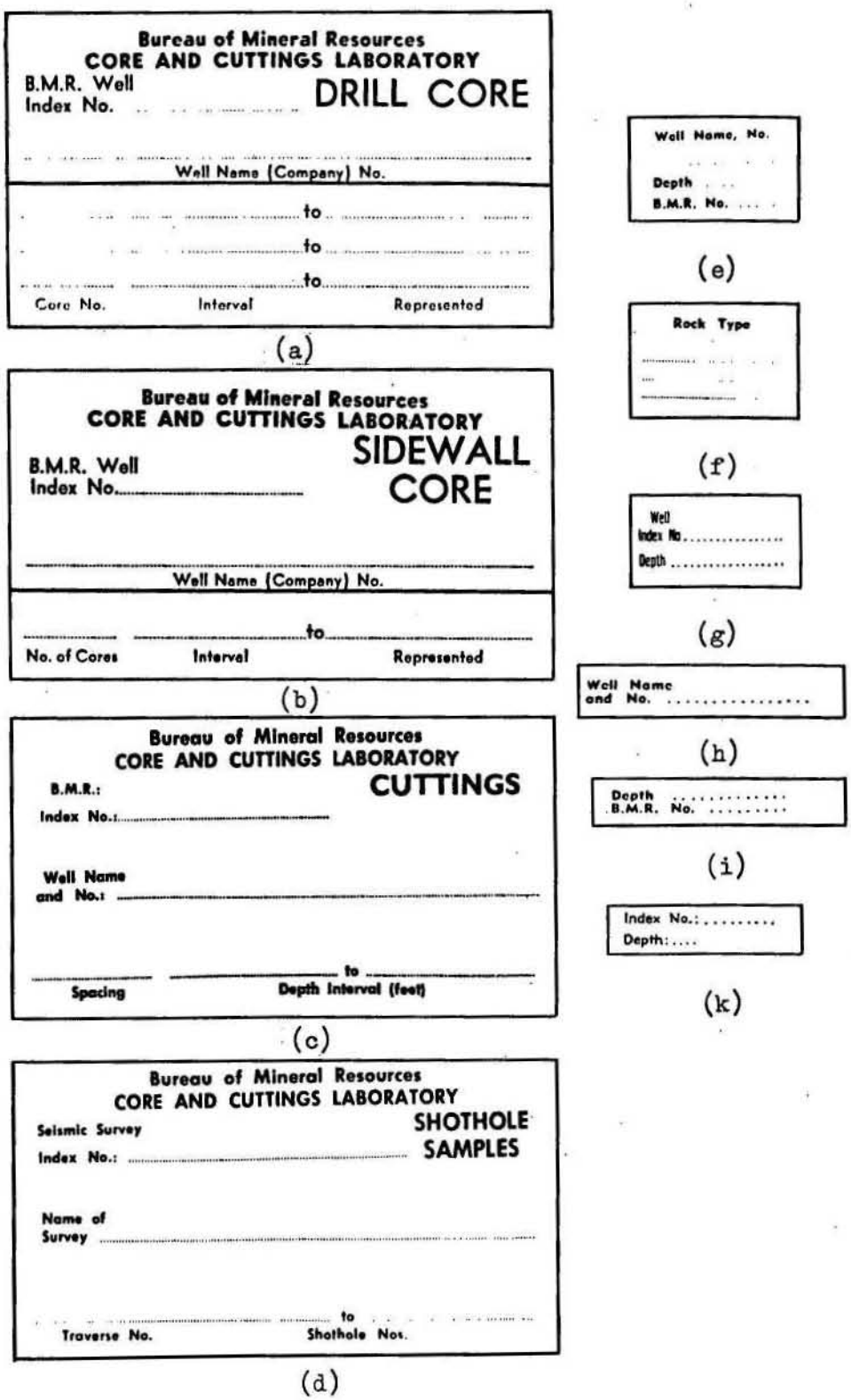

Figure 3. Pressure sensitive labels used in the Laboratory.

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speed up the registering of cuttings, the name of the well and index numbers are stamped on each bag (prior to registering), by a subcontractor using conventional envelope - addressing equipment. The Laboratory staff need only write on the depth interval of each sample with a ball-point pen. The bag is closed with a "Twistem" - a paper covered wire strip that passes through a slot at the top of the bag. The bags stand upright in the cardboard boxes in order of depth (Fig. 1). The two channel box used for cuttings is the same as that used for the bulk of the drill core received. However, the contents of the boxes are immediately apparent because of the colour code incorporated into the labels, which are placed on both box and lid. (For details of labels see Fig. 3 (c).). The colour of labels used for cuttings is pink.

(d) Seismic Survey Shothole Samples

The treatment of seismic shothole samples is identical to that for drill cuttings described above; however the seismic material is indexed independently under the Seismic Survey Index Numbers, and is considered as part of the overall pattern of holes making up the survey rather than independent drilling operations. The seismic samples are stored separately from other cuttings and are readily identified by the blue colour code of the labels - both on the bags and on the cardboard boxes containing them; see Figs. 1 and 3 (d).

(e) Representative washed cuttings and specialist material

Small samples of handwashed cuttings, or cuttings which will be washed by the automatic washing and drying machine are stored in glass vials, fitted with polythene clip-on-tops (the smallest of the

vials shown in Fig.1). The vials are stored in partitioned cardboard cartons and are stored separately from the other types of material from the same well. This was necessary because of the entirely different methods of storage required and because of their specialized use; the vials can only be used for reference purposes or for visual examination under the microscope, - but not for any type of analysis. These reference samples are kept in a separate section of the Store, together with thin sections, "buttons*, concentrates and residues. Again the key to locating this specialist material is the Well Index Number. The various labels used for reference materials are shown in Fig. 3 (e to k).

(f) Fluid samples - oil, gas, condensate, water

The Laboratory receives all samples of this type submitted to the Bureau of Mineral Resources, but actual tests are carried out in the Petroleum Technology Laboratory. Portion of the oil and condensate samples are retained as part of the permanent reference collection.

3. RECORDING OF DATA RELATING TO SAMPLES HELD BY THE LABORATORY

(a) Project Files

The Laboratory keeps copies of all correspondence relating to submission of material from each well, exploration programme and seismic survey, in individual project files. The more important data are transferred to the Well Information Book for quick day-to-day reference.

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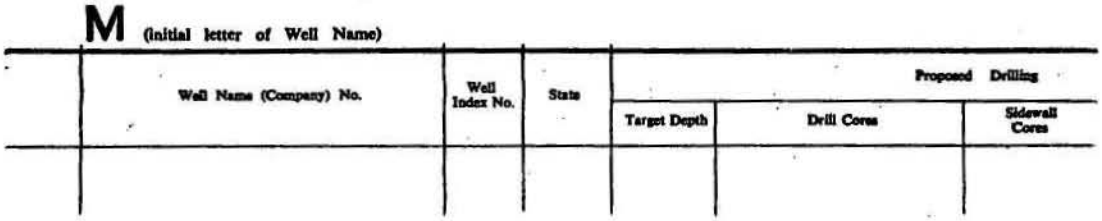
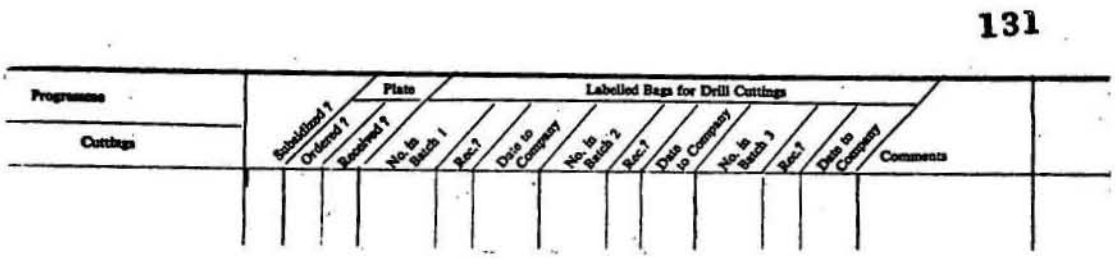
* "Button is the name given to discs approximately 1 inch in diameter, and $\frac{1}{4}$ inch thick, consisting of drill cuttings embedded in clear resin and protected by cover slips on both sides (see Fig.1, fourth from right, in front row).

(b) Well Information Book

This book is arranged, so that the wells are grouped according to the first letter of the well name. In this way, a rough alphabetical order of wells is maintained. Each entry occupies the full width of the two adjacent pages of the book. The headings of these pages are shown below in Fig. 4.



(a)



(b)

Figure 4. Page headings of Well Information Book.

(a) Left hand page (b) Right hand page

(each page 8" x 13")

In Figure 4, the "plate" refers to an "Addressograph" Plate - the type used in automatic addressing of envelopes; it is prepared by a sub-contractor, and shows the Well Name and Number, Operating Company, and Well Index Number. This plate is used for the speedy labelling of the

polythene bags, in which the drill cuttings are stored. "Labelled Bags for Drill Cuttings" refers to a service offered by the Laboratory to the drilling company, whereby pre-labelled cuttings bags will be sent to the wellsite prior to drilling, providing the following information is sent to the Laboratory at least four weeks before spudding in:

- correct well name
- target depth
- intervals at which cuttings will be caught.

This service is advantageous to the driller, who does not have to provide bags for the Bureau's share of cuttings, and also to the Bureau as it avoids any re-bagging of samples in the Laboratory.

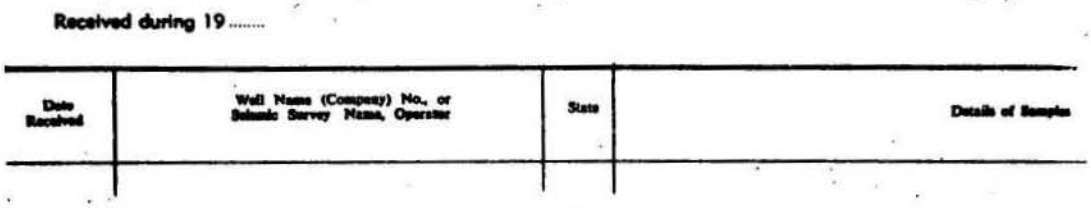
The Well Information Book has two main functions:

(i) It is commonly the only quick reference to a well which is still in its planning stages. This function is very important during the initial stages of operation, prior to the arrival and registration of the samples.

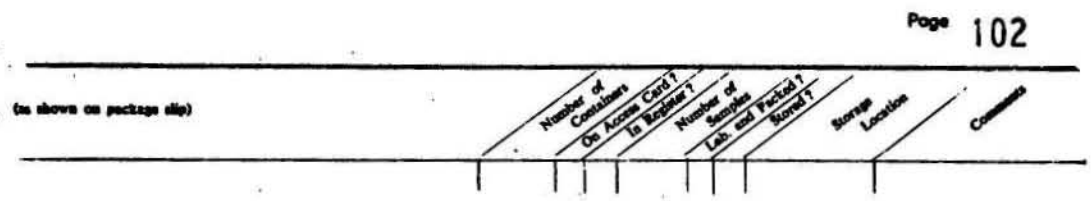
(ii) The book provides one form of cross reference from the well name to the well index number. As soon as it is known that material is to be received at the Laboratory from a well not formerly represented in the collection, a Well Index Number is given. This number is the basis for all phases of storage and subsequent treatment of the samples within the Laboratory, and for all loans of samples from the Laboratory.

(c) Receivals Book

Details of each batch of samples received in the Laboratory are entered in the Receivals Book. The entries are in strict chronological order, under the headings shown below. Again two adjacent pages are used for each entry :



(a)



(b)

Figure 5. Page headings of Receivals Book.

(a) Left hand page; (b) Right hand page

(each page 8" x 13")

The headings shown in Figure 5 with question marks require only an affirmative tick to show the operator if these particular steps have been taken.

WARRINILLA (Planet) No1.
Well Name (Company) No.

CORE AND CUTTINGS ACCESSION CARD

21.
Well Index No.

This card to remain at all times in Registration Room, Core and Cuttings Laboratory

Core No. Interval cored Recovery—feet	DRILL CORE Interval of sample	Core No. Interval cored Recovery—feet	DRILL CORE Interval of sample	Core No. Interval cored Recovery—feet	DRILL CORE Interval of sample					SIDEWALL CORE No.	SIDEWALL CORE Depth
Received:	22. 6. 1963.									Received: 23.7.65.	
	493'-93'3½"									5	1493'
	495'-95'4"									4	1494'
Core 1	497'-97'3"									3	1495'
492'-507'	499'-99'4"									1	1499'
15'0"	501'-01'3½"										
	503'-03'3½"										✓
	505'-05'4"										✓
	506'9"-07'										✓
	831'-31'5"										
Core 2.	833'-33'4"										
830'-840'	835'-35'4"										
10'0"	837'-37'4"										
	839'-39'4"										
	1321'-21'3½"										
Core 3	1323'-23'3½"										
1320'-1334'	1325'-25'3½"										
14'0"	1327'-27'3½"										
	1329'-29'4"										
	✓										
	✓										
	✓										
Received:	5. 7. 1963.										
Core 3 cont.	1331'-31'4"										
1320'-1334'	1333'-33'3½"										
14'0"											
	1618'-18'4"										
Core 4	1620'-20'4"										
1617'-1627'	1622'-22'4"										
8'0"	1624'-24'4"										

Figure 6. Front side of Core and Cuttings Accession Card. (Actual size : 10" x 8").

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DRILL CUTTINGS—Unwashed				CUTTINGS—Washed		CONCENTRATES			CUTTINGS "BUTTON"		THIN SECTION	
Depth Range	Spacing	Depth Range	Spacing	Depth Range	Spacing	Type and Depth			Depth Range	Spacing	Depth	
Received: 1.8.63												
40' – 490'	10'											
490' – 500'	5'											
500' – 830'	10'											
830' – 840'	5'											
840' – 1320'	10'											
1320' – 1340'	5'											
1340' – 1620'	10'											
1620' – 1630'	5'											
1630' – 2230'	10'											
[illegible]	[illegible]											
[illegible]	✓											
[illegible]	✓											

Figure 7. Reverse side of Core and Cuttings Accession Card.
(Actual size : 10" x 8").

(d) Registration of Material

(i) Core and Cuttings Accession Card (Figure 6).

Details of the cores received are registered on one side of this card, (Figure 6) which shows all samples received, their relevant depth intervals, limits of error (if any), type of marking on the cores and the mode of storage. The cards are kept in the numerical order of Well Index Numbers, and are stored in the Registration Room. Cuttings from the same well are registered on the back of the Accession Card, see Figure 7. The Accession Card for Seismic Shothole samples is modelled along similar lines.

(ii) Core and Cuttings Register (Figure 8).

A summary of the information given on the Core and Cuttings Accession Card, and in the Receivals Book, together with the records of all people who had use of the material - both inside and outside of the Laboratory - are given in the Core and Cuttings Register under the following headings:

Well Index No. 864

Well Name (Company) No.

MATERIAL REGISTERED IN LABORATORY

Date Received	Drill Cores	Side Wall Cores	Cuttings	No. of Cartons			Storage Location	Details on Access. Card
				Drill Core	Side Wall Core	Cuttings		

(a)

Well Index No. 864

MATERIAL BORROWED—for work both inside and outside the Laboratory.

Drill Core	Side Wall Core	Cuttings	No. of Cartons	Borrower		Date		Comments
				Person	Section	Borrowed	Returned	

(b)

Figure 8. Page headings of Core and Cuttings Register

(a) Left hand page. (b) Right Hand page

(Each page: 8" x 13").

Another heading of the Register which occurs half-way down the left-hand page and is therefore not shown in Figure 8 (a) - is "Notes", under which the following types of entries are shown:

Sources of material;

Conditions of agreement with the Operating Company;

Condition of material on arrival from the wellsite;

Condition of material after each borrowing;

Details of material that is confidential;

Details of material that cannot be used for destructive analysis because of scarcity of samples.

The Register is set out so that each pair of adjacent pages refer to a particular Well Index Number. Each volume of the Register lists 250 Well Index Numbers, in lieu of page numbers.

(e) Notification and acknowledgement of receipt of material - Core and Cuttings Receipt Advice (Figure 9).

A Receipt Advice is completed as soon as a batch of material is registered. This form has two functions:

(i) it is the basis for acknowledging receipt of samples from outside organizations;

File No.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLEUM EXPLORATION BRANCH
CORE AND CUTTINGS LABORATORY

CORE AND CUTTINGS RECEIPT ADVICE

The following samples have been received at the Core and Cuttings Laboratory, Fyshwick, A.C.T.:

Well or Survey Name and No.:

Name of Tenement Holder:

Name of Operator:

Location of Well or Survey (including State):

Lat.: Long.: 1:250000 Sheet No.:

Drill Core received:

Core No.	Interval Cored	Recovery (as footage)	No. of Samples

Sidewall Core received (sample number, and depth):

Cuttings received (intervals at which cuttings taken, and depth limits of those intervals):

Seismic Shothole Cuttings received (traverse lines, and number of samples per line):

Distribution List:
Chief Petroleum Technologist
Chief Geologist
Palaeontology Section
Subsidy Group
Sedimentary Basins Study Group
File

Material received by date

acknowledged by date

3333/64. By Authority: A. J. ARTHUR, C'wealth Govt. Printer, Canberra.

Figure 9. Core and Cuttings Receipt Advice.
(Actual size: 13" x 8")

(ii) it enables officers of the Bureau to know what material is available for study - for material cannot be borrowed until it has been registered, except in special cases.

Copies are completed and distributed to the various sections and groups within the Bureau, and it also forms the basis of interdepartmental monthly reports.

(f) Records of Material Borrowed

Details of material borrowed from the Store are entered on:

(i) Request for Material Form (Figure 10).

(ii) Core and Cuttings Register, (Figure 8). or Seismic Sample Borrowing Book.

Every time samples are borrowed from the Store for any form of examination carried out within or outside of the Laboratory, either by the Bureau or by other personnel, - a Request Form must be completed by the borrower. Regular borrowers are supplied with books of these Request Forms. When material for examination is required, the borrower fills out a Request Form for each well or Survey to be examined, and the forms are sent to the Record Section of the Laboratory by the daily-roundsman. In case of urgent requests, made by telephone, the Record Officer who receives the message in the Laboratory fills out the Request Form.

In the record section of the Laboratory, the officer writes the "standard" Well Name and the Index Number of the well or survey on the form. If the wanted material is held by the Laboratory, the Request Form is forwarded to the storeman who marks on it details of the cartons of material supplied. The completed form is sent by the storeman to the Record Section, where the officer enters the details of the loan in the

Forward completed Request Form to:

GEOLOGIST-IN-CHARGE, CORE AND CUTTINGS LABORATORY

REQUEST FOR MATERIAL from Core and Cuttings Lab.

Date of Request			Type of work to be carried out	
Name of Borrower	Section of B.M.R., or Name of Company		Palaeontology	
			Palynology	
WELL NAME (Company) No.		Well Index No.	Petrophys. Anal.	
			Sediment. Petrol	
CORE requested	Cores supplied	No. of Cartons	Thin Sectioning	
			Button Prep.	
CUTTINGS requested	Cuttings supplied	No. of Cartons	Physical Sep.	
			Calci-Log Anal.	
SEISMIC SURVEY NAME		Survey Index No.	D.T.A.	
			Radio Age.	
SHOTHOLE SAMPLES requested Traverse: Points:	Samples supplied Traverse: Points:	No. of Cartons	Wash Cuttings	
			Other Work:—	
OFFICE USE ONLY		Entered in Register?		
Date Despatched:		Entered on Well Data Card?		

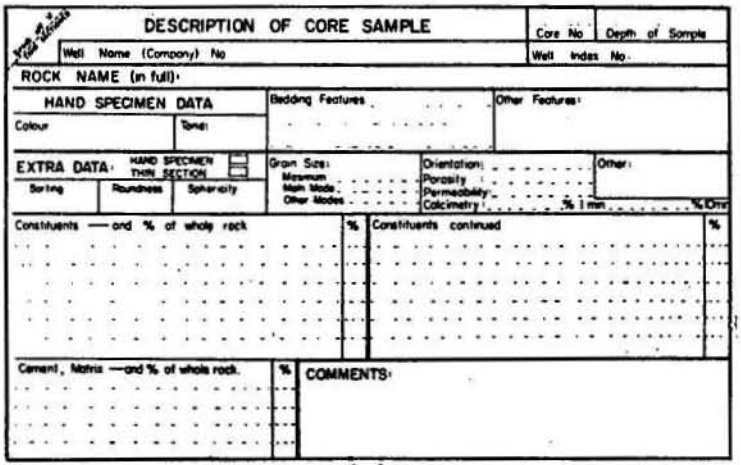
Figure 10. Request for Material Form.
(Actual size: 6" x 5½".)

Seismic Sample Borrowing Book, or in the Core and Cuttings Register (the layout of headings is shown in Figure 8 (b)). Finally the appropriate entries are made by the records officer on the Well Data Index Card. (This is fully explained in Part II of this paper.)

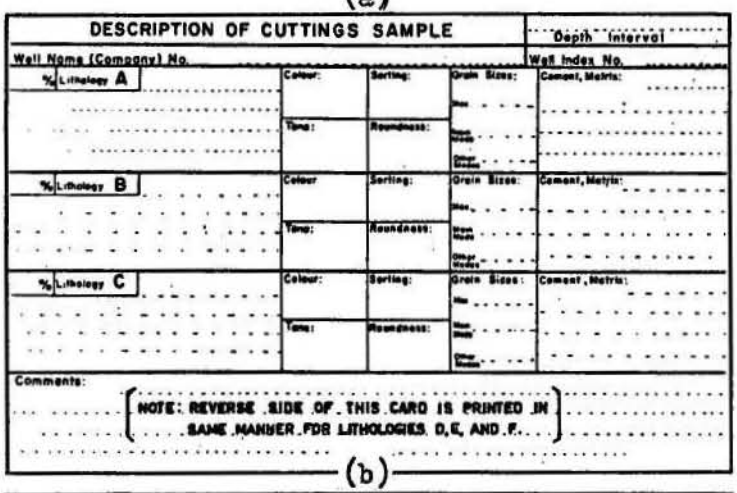
(g) Results of Studies on the Material

Most petrographic descriptions of cores and cuttings are made in the Laboratory where full facilities are available. The types of work cards used to formalize the examination are illustrated in Figure 11 (a.b.c.); the headings are self-explanatory. These cards are prepared by the geologist examining the material, and remain with him until he has prepared the draft report. At that stage, the cards are filed away in the Laboratory - again under the Well Index Number for easy retrieval. Those dealing with cores and cuttings are readily distinguished by use of the standard colour coding. A similar system is used for other tests and examinations; an example of the log form for phosphate tests is shown in Figure 12. These cards are also filed under the Well Index Number. If a re-examination is to be undertaken, the earlier descriptions and specialist materials can be supplied together with the cores and cuttings.

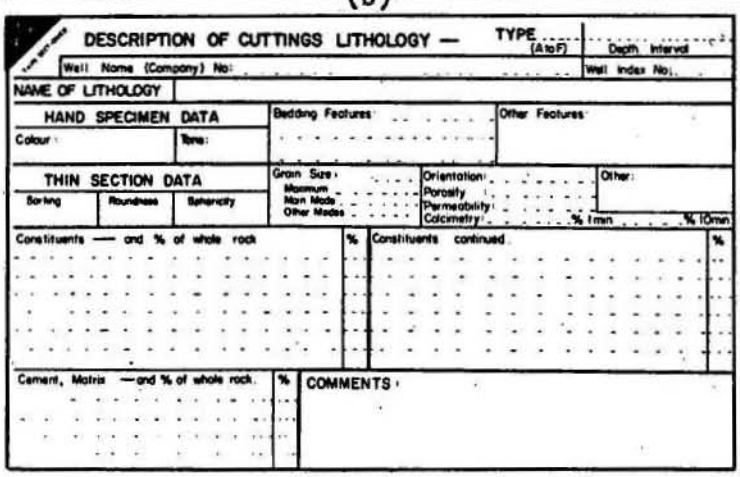
Wherever possible, the written reports, results of examinations or analyses of samples carried out away from the Laboratory are also kept by the Laboratory. If the reports as such are not available, the summarized contents are kept in the project files, and the references to the full reports are given on the appropriate Well Date Index Cards.



(a)



(b)



(c)

Figure 11. Lithological Description Cards
(Actual size: 8" x 5")

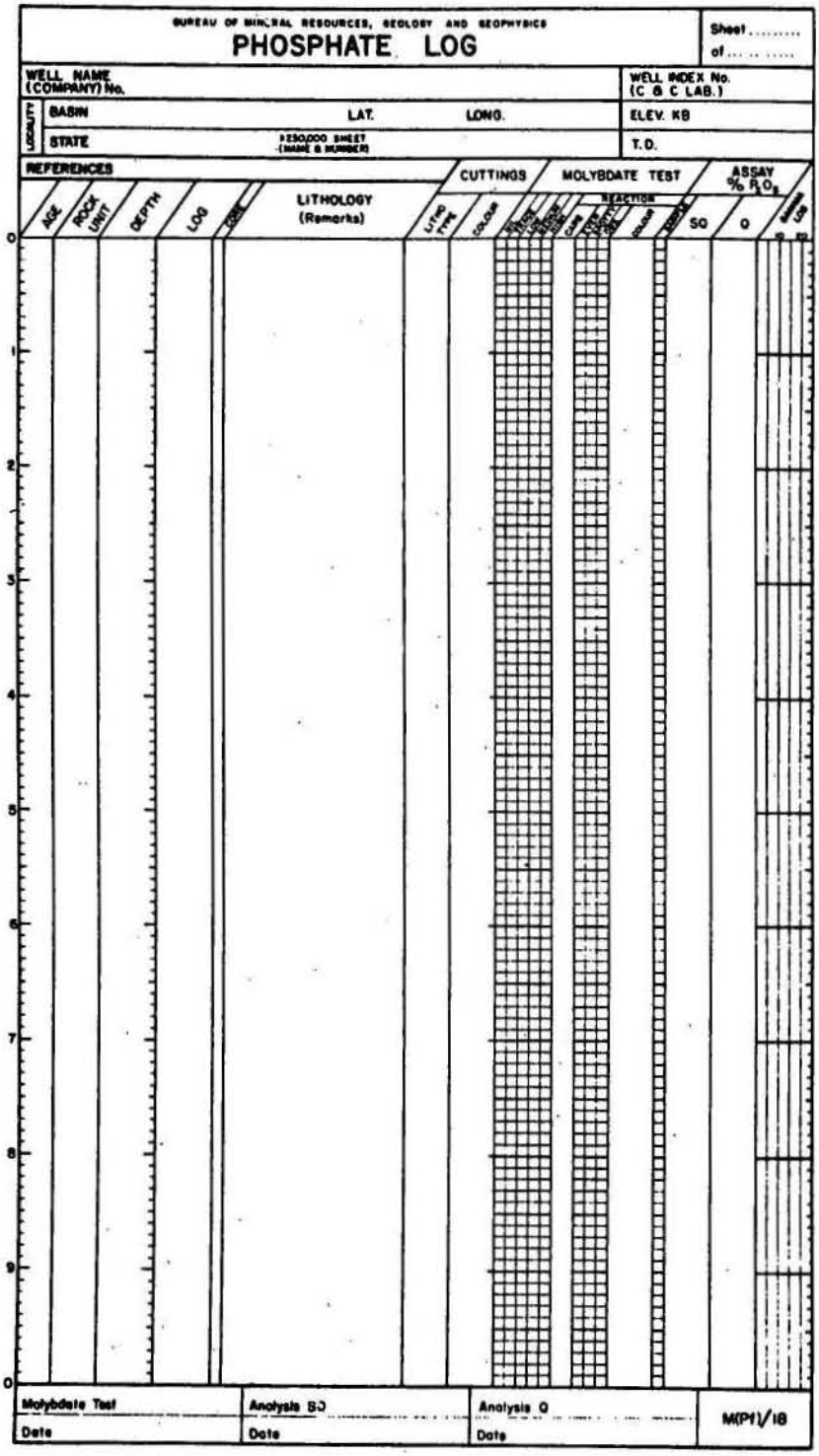


Figure 12. Phosphate Log for use with subsurface samples. (Actual size: 13" x 8").

PART II

DOCUMENTATION OF WELL DATA FROM THE SEDIMENTARY BASINS OF AUSTRALIA AND ITS TERRITORIES

1. FUNCTIONS OF THE WELL DATA SYSTEM

A comprehensive system for the storage of data from wells * drilled in the sedimentary basins of Australia and its Territories has been in use in the Core and Cuttings Laboratory. This system embraces all data of geological significance, and is not restricted to wells represented in the collection of the Laboratory, nor to wells drilled specifically for oil or gas.

The Well Data System is designed to fulfil the following two main objectives:

- to satisfy the needs of both the petrological and technical staff for the routine work of the Laboratory;
- to answer queries from other Bureau personnel and from outside geologists.

To satisfy these two objectives, the system has had to be sufficiently comprehensive to answer the needs of the specialist and those of the visiting geologist; yet it needed to be flexible enough to allow for quick sorting of a very wide range of general information about the well - status and results of drilling, availability of samples,

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* "Wells" as used in this paper, cover drill holes ranging in depth from a few hundred to thousands of feet in depth, and drilled for a variety of purposes - oil test, gas, coal, phosphate, water etc.

references to reports, etc. It has been designed primarily to assist the geologist, but it can also be of some value to other branches of the oil industry. It is obviously not possible to supply all specialized data, however references to detailed information are given. In addition, safety devices are built into the system to ensure that the confidential status of some of the information is maintained.

The Well Data System is made up of the following components:

Index of well names

Index of well data

Visual map index of wells

Cross-references between components.

2. INDEX OF WELL NAMES

The Laboratory's system of information retrieval must be based primarily upon the sorting of information regarding individual wells. Consistent naming of the wells is therefore extremely important. Various systems of well-naming are used in Australia; some of these are not suitable for quick information retrieval, and some could lead to misidentifications of wells. For these reasons, the Core and Cuttings Laboratory uses its own system of "standard" well names in its records and on sample containers:

Geographic Name (Operating Company) Number

Alphabetical filing and efficient operation of the filing system is possible when the nomenclature is consistently used in this form. Cross-references are provided (see below: Index of Well Data) to enable people only familiar with other, "non-standard", forms of the well name to make use

of the index. Where no geographic name was given to a well, but only the company name and a number - a name based on the nearest geographical locality is allocated to the well by the Laboratory. However in all cases the original version of the well name is retained in the cross-references. The Company name which follows in brackets after the geographical name is generally abbreviated. Examples of types of names are given below:

"Non-standard" Well Name	"Standard" Well Name
Union-Kern-A.O.G. Moonie No. 1	- Moonie (Union) No. 1
A.R.O. No. 11	- Blythdale (A.R.O.) No. 11
Exoil East Mereenie No. 1	- Mereenie East (Exoil) No. 1
Cockatoo Bore	- Twin Hill (Prov.Oil.Co.) S.H. No. 1
Railway Bore	- Charleville (Qld.Rwy) W.B.

If the well was not drilled primarily for oil exploration, the abbreviated objective is given before the well number.

S.H. (Scout Hole)

W.B. (Water Bore)

C.B. (Coal Bore) etc.

The advantage of this type of naming is that all information about wells drilled by the various private enterprises or governmental agencies in a particular area will tend to be filed close to one another. As most enquiries in the Laboratory are directed towards gaining as much geological information as possible about a certain locality, area or sedimentary basin, - this principle has been found very useful.

3. INDEX OF WELL DATA

(a) Well Data Index Card (Fig. 13,14).

This card could be considered as the "Master Card" of the system. It has a twofold objective:

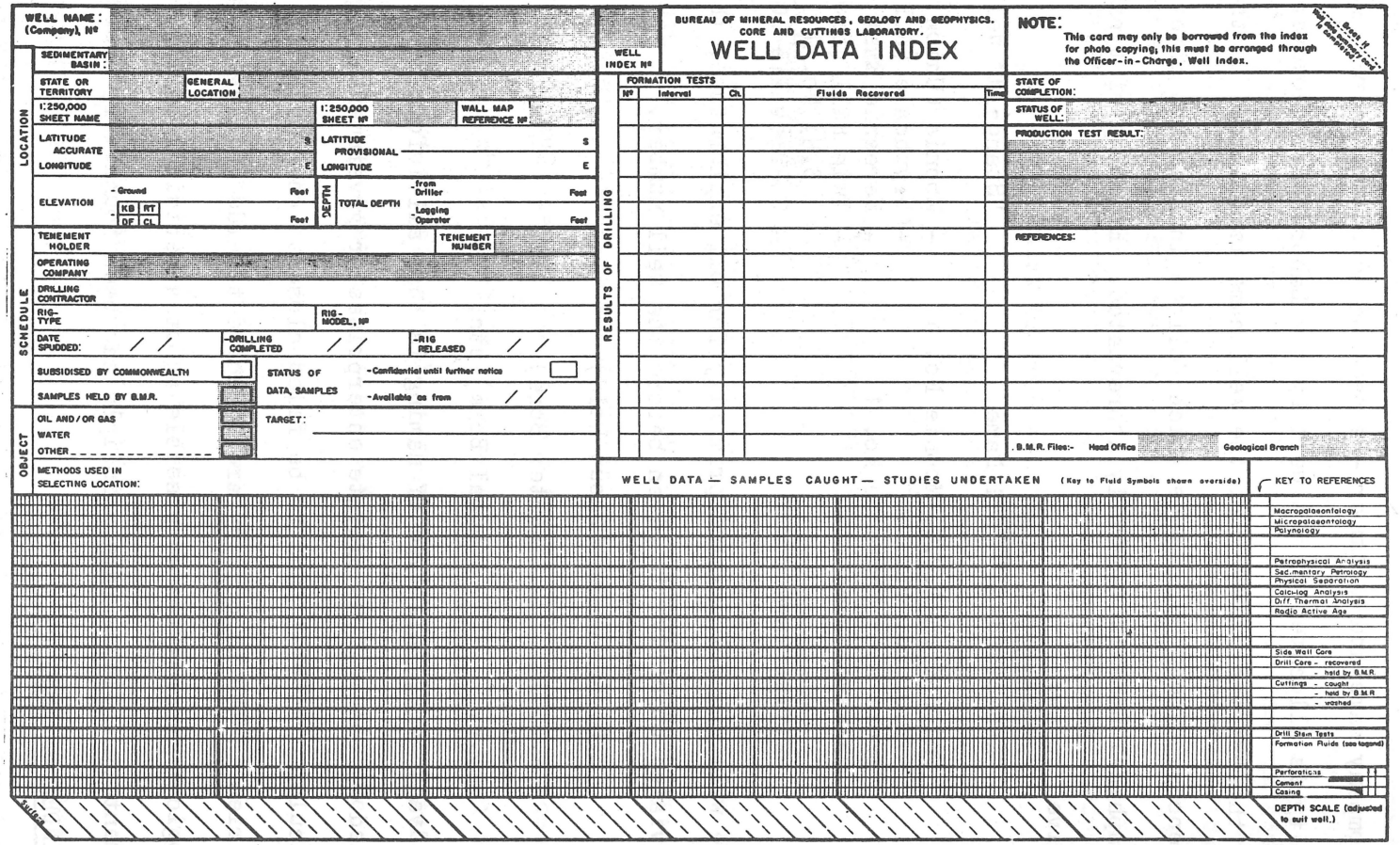


Figure 13. Front side of Well Data Index Card.
(Actual size: 13" x 8")

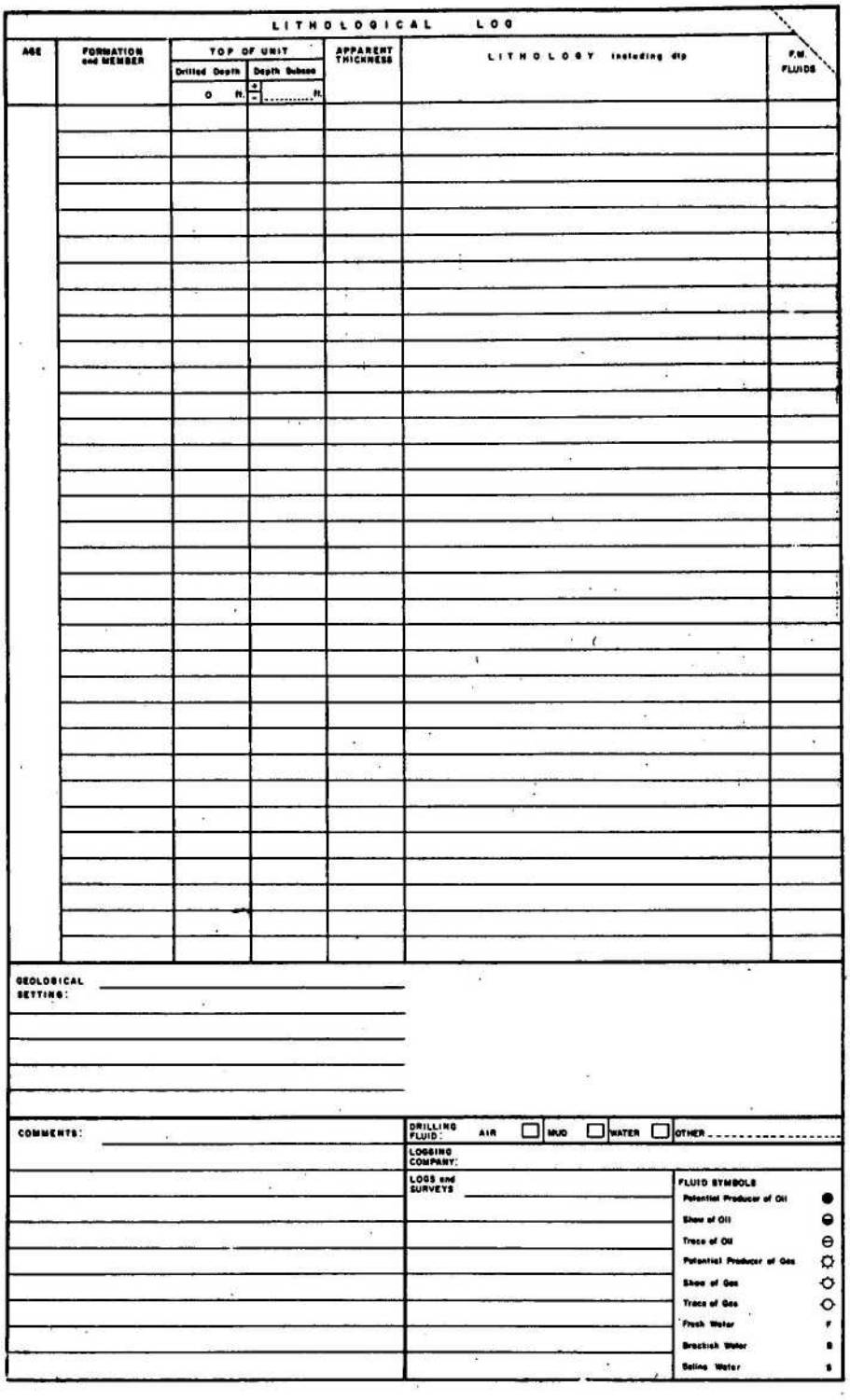


Figure 14. Reverse side of Well Data Index Card. (Actual size: 13" x 8").

(i) to answer the bulk of queries concerning the results of drilling operations. The card will give details of the regional geological setting, final results, stratigraphic units and lithologies encountered in the well, and a limited amount of drilling and technical data. In addition the card also gives a key to studies undertaken on the samples from the well and references to the relevant literature.

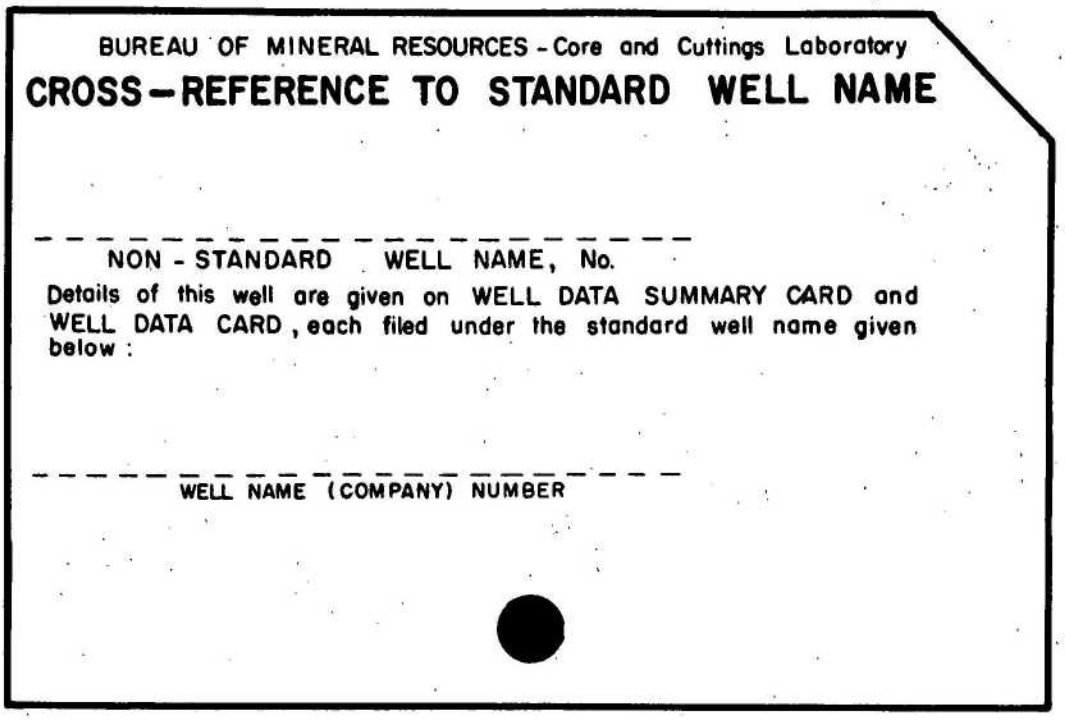
(ii) the cards will be the input to a punched card information storage and retrieval system, which is still in the planning stage. All the required, known information about a particular well is "pigeon-holed" on the Well Data Card in a summarized, non-subjective form, suitable for conversion into punchable data.

The Well Data Index Cards are filed under the appropriate sedimentary basins, and within each basin in alphabetical order of well names. Easy retrieval of the cards is essential, as the cards are handled several times before all data are entered onto them.

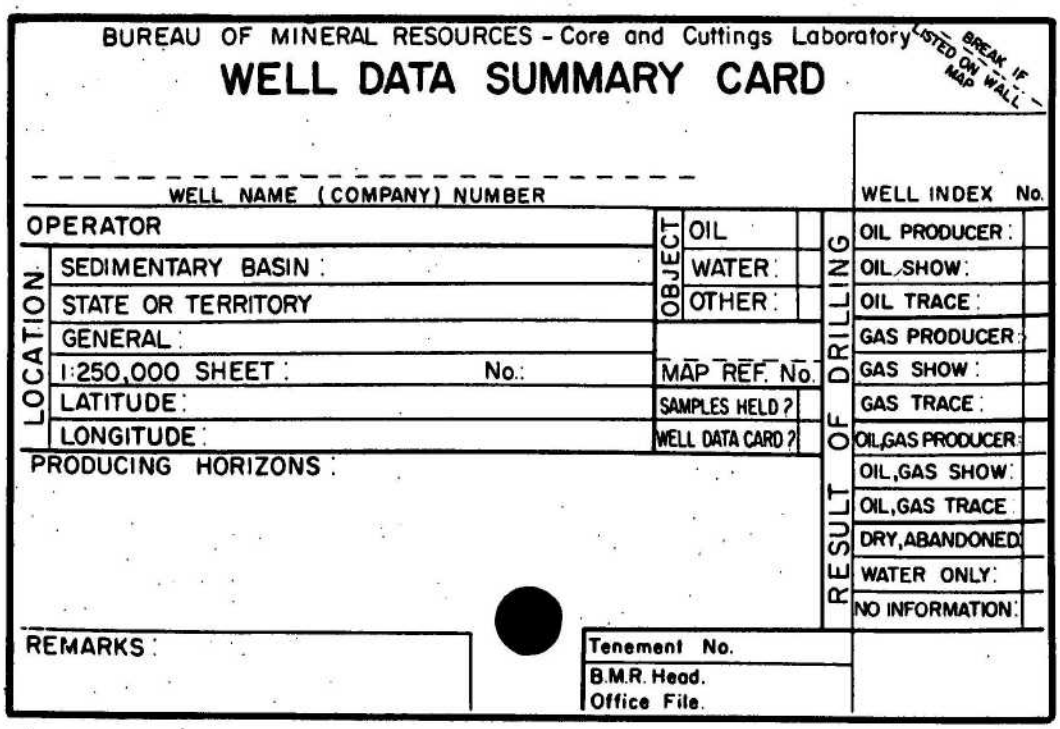
(b) Well Data Summary Card. (Fig. 15 (b)).

To save the Well Data Cards from excessive handling for the great many needs of the Laboratory, the Well Data Summary Cards are used. Since the information given on the Well Data Summary Card is always obtained from the Well Data Index Card, inconsistency cannot occur. The transferring of data is facilitated by the shading on the Well Data Index Card. The functions of the Well Data Summary Cards are set out below:

(i) the cards are used to obtain basic information required by the Laboratory staff during all phases of registering material:



(a)



(b)

Figure 15. Cards used in the Index of Well Names
(a) Cross Reference Card
(b) Well Data Summary Card
(Actual size: 6" x 4")

standard well name, index number, locality of the well, etc. The main headings, together with the headings on the left side of the cards are referred to in these cases; once these headings are filled in, the Summary Card is secured in proper order within the filing cabinet by means of a metal spike passing through the holes at the bottom of the cards. Routine information- retrieval does not necessitate the removal of the cards from the cabinet, and there is little danger that the strict alphabetical order might be lost. The whole deck of card cabinets is mounted on a trolley for added convenience.

(ii) The Well Data Summary Card supplies the information needed by the officer responsible for the Visual Map Index of the Wells - dealt with in detail in the following section. This Visual Map Index uses information relating to the completed state of the well - information that is only available after the Summary Cards have been secured in the filing drawers. However, the cards are so arranged, that a tick (in the affirmative) on the right side of the card gives the necessary information, and there is no need to remove the card from the drawers. When the process of plotting on the Visual Map Index is completed, the perforated corner of the card is broken off.

(iii) The Well Data Summary Card provides the necessary links in the operation of the whole information retrieval system, when the confidential status of the data listed on the Well Data Index Card must be safeguarded. As it does not show confidential information, it can be used instead of the Well Data Index Card.

(c) Cross-Reference Card (Figure 15 (a)).

A Cross-Reference Card is completed for each "non-standard" well name. Each card also shows the "standard name" under which the detailed information is to be found. The Cross-Reference Cards and the Well Data Summary Cards are filed together in alphabetical order, and used as one unit. This system, standardizes the nomenclature on an Australia-wide basis.

4. VISUAL MAP INDEX OF WELLS (Figures 16 and 17)

The Visual Map Index of Wells has been prepared to show the pattern of oil exploration and the results achieved in all of the sedimentary basins of Australia. This index is not only decorative, but forms an essential part of the system of information retrieval. Not only does it give generalized information at a glance, but it also permits information retrieval based on features not catered for in our simple alphabetical index - currently drilling or completed operation, object and result of drilling, detailed location, availability of material, intersected producing horizons, etc.

The Visual Map Index of Wells consists of two components:

- Plot of Well (coloured pins)
- Map Reference to Well (cardboard inserts.)

The interrelations of the two components are shown in Figure 16, and the actual mode of presentation on the Wall Maps in Figure 17.

Wherever possible, geological maps are used as base maps, ranging in scale from 1:234,400 to 1:500,000, according to the importance of the area or to the density of wells. A well is plotted on the map by

means of a long-stemmed (1¼") pin. The Key to the wells is mounted around the map and consists of Map Reference Inserts. The link between the plot of the well and the related map reference insert is the Map Reference Number. This number appears on a small flag attached to each pin, and also on each insert. It has no other purpose than to provide a "two way traffic" for the enquiries between the two components.

The Key consists of a series of light metal frames, into which the cardboard inserts are clipped. The inserts are grouped primarily according to sedimentary basins, but within each basin the subdivision is based on the grid areas * shown on the map. When referring to these areas, standard letterings and numberings are followed: e.g. Se 51-7. The individual inserts, each representing a particular well, are arbitrarily numbered from one onwards in each grid reference area; thus the sixth well listed on the 1:250,000 sheet SE 51-7 will be SE 51-7-6. This last number (6) is the Map Reference Number.

The following information is typed into the inserts:

- Map Reference Number (typed in black)
- Standard Well Name (typed in black)
- Well Index Number (typed in red), but the Well Index Number will only be available if samples from that particular well are held in the Laboratory.

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* When using 1:2,534,400 scale base map, the grid areas correspond to the standard 1:250,000 map areas; when 1:500,000 scale base maps are used, each grid area represents 30" of latitude by 30"of longitude.

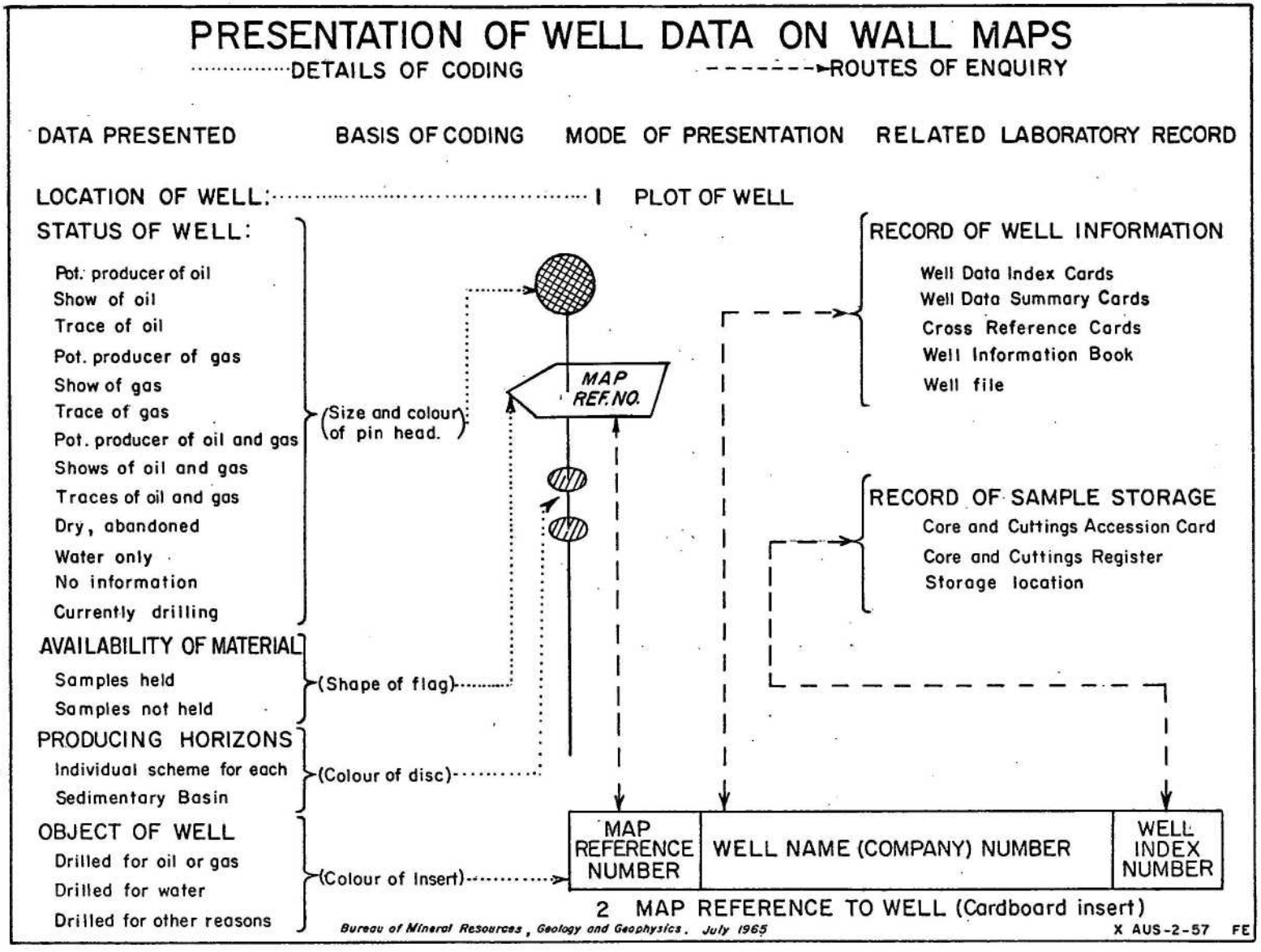

Figure 16. Diagram showing presentation of Well Data on Wall Maps.

When a new well has been completed, the corresponding Map Reference Insert can easily be fitted into the Key in its correct place, as the order of the individual inserts can be changed. In practice it has been found more useful to keep the inserts in the numerical order of their map reference numbers, within each grid area, rather than in alphabetical order, because the bulk of the enquiries originate on the map itself and not on the map reference.

To increase the scope of the system, a colour code is used on both the inserts and the pins. The colour of the insert is determined by the object of the well:

drilled for oil/gas . . . . . .pink

" " water . . . . . .blue

" " other reasons . . . .buff

The colour of the pin head depends on the results and final status of the well. Wells, in which oil has been recovered are plotted by the red pins, gas and condensate by yellow. A brown pin marks a well where both oil and gas have been recovered.

The division into "potential producer", "show", and "trace" is shown by using three sizes of pin head in each of the above colours. The boundaries between the divisions are defined below:

Potential Producer of Oil - Tests exceed 100 barrels per day

" " " Gas - " " 1,000,000 cubic feet per day

Show of oil - a measurable quantity of oil, but less than 100 barrels per day

Show of gas - a measurable quantity of gas, but less than 1,000,000 cubic feet per day

Trace of oil - a positive indication of oil

" " gas - " " " " gas

This threefold classification (and the figure arbitrarily given to each group) is a simplification of the problem, for it does not take into account the location of the well with respect to pipelines or markets; in addition controls will differ from one type of production test to another. However in this early stage of oil exploration in Australia, the significance of small amounts of oil and gas cannot be ignored.

Each map board consist of a softwood frame 54 inches x 48 inches, with plywood backing, and a smooth cork mounting surface. The frame extends 1½ inches forward of the mounting surface to provide protection for the pins. The boards are supported in a map rack, and fitted one behind the other (see Figure 17). Each board is secured to the rack by means of tracking - similar to the type used for sliding doors. Any map can be slid from the left side of the rack, into the viewing area on the right side. A key map, mounted on the front of the rack shows the areas that are covered by the various numbered map boards.

The increasing rate of drilling will doubtless require further enlargement of certain areas, but the system of visual presentation is flexible and will be able to cope with this problem. In the case of enlargements and additions, a logical order within the rack can be

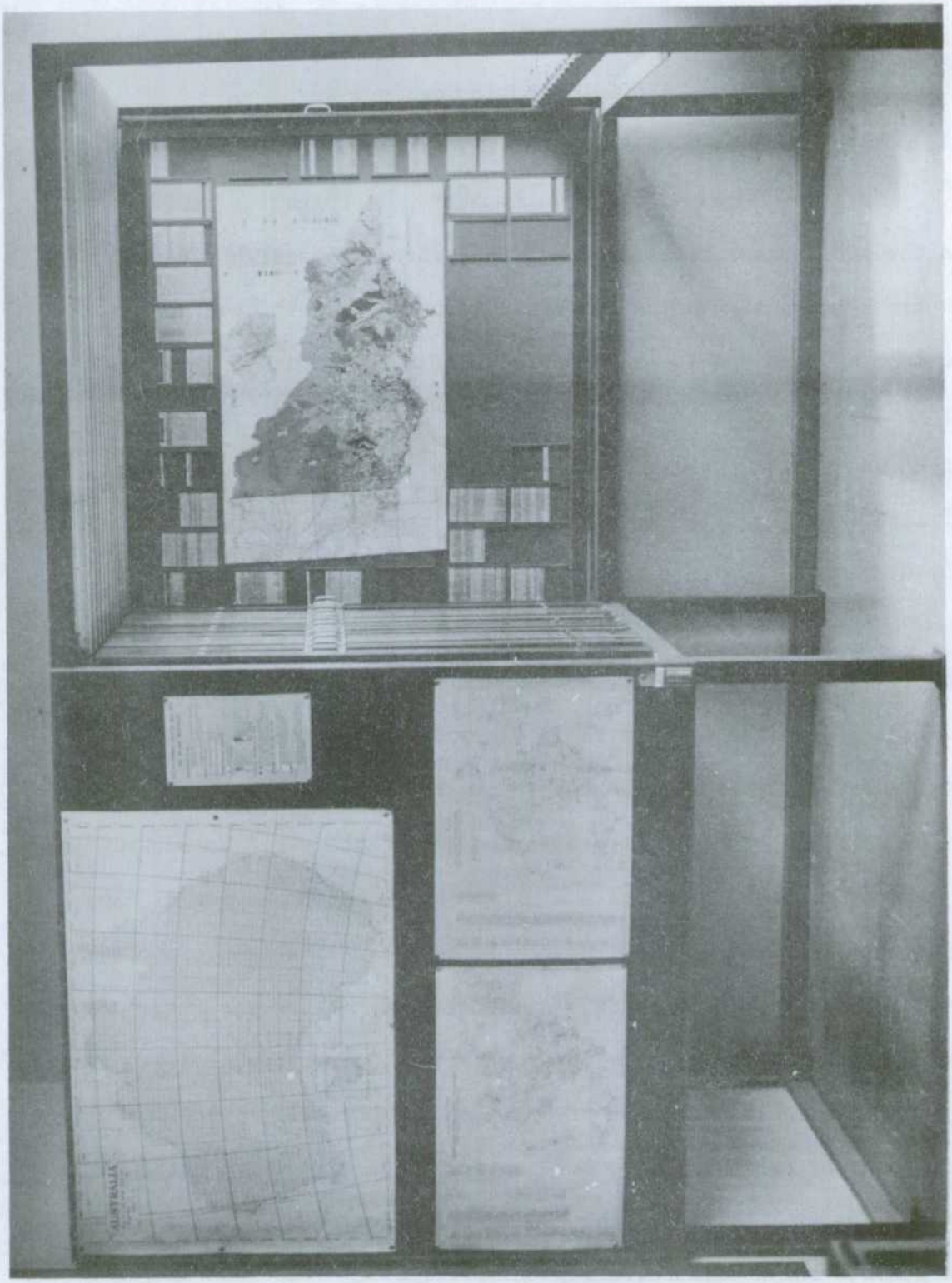

Figure 17. Map Rack containing 12 Map Boards making up the Visual Map Index of Wells. Map Board showing wells in the Otway and Gippsland Basins is in viewing position. (Actual size of Map Boards: 54" x 48")

maintained by rearranging the boards.

5. INTERRELATION OF COMPONENTS - ROUTES OF ENQUIRY

When a general enquiry is made concerning the subsurface geology or the extent and results of drilling within a particular area, the initial reference is to the Wall Maps where the wells of interest are identified.

The enquiry can also proceed from a locality on the geological map - where the pins show such details as intersected producing horizons, and the status and final results of each well - to the "standard" well name or to the Well Index Number, which are given in the Reference Inserts of the Key. The "standard" well name provides a direct link with the Well Data Index, while presence of the Well Index Number indicates availability of samples. On the other hand, if only the "standard" well name is known, the precise location of the well with respect to geological or geographical features or to nearby drilling operations can be readily found by reference to the appropriate Wall Map. If only the "non-standard" well name is known the system becomes operational once the "standard" name or location of the well is found from the alphabetically indexed Well Data Summary Cards and Cross-Reference Cards. The full range of possibilities in information retrieval is shown diagrammatically in Figure 16.

CONCLUSIONS:

The system outlined above has evolved gradually, and doubtless some slight modifications would be made if we had the opportunity of re-designing the entire system. But in the main it has proved satisfactory and I am sure meets a very real need both within and outside the Bureau.

One of the difficulties in this work is the wide variation in accuracy of the information supplied to the Laboratory. To improve the quality of this information, standard forms are being drawn up that will be distributed throughout the industry and governmental agencies in the near future. Another difficulty - particularly in handling old wells - has been the lack of uniformity in the methods of naming wells.

It is expected that the relatively simple methods of indexing described in this paper will serve the needs of the Bureau in this field for some years to come. However, with the ever-increasing tempo of oil exploration, it is inevitable that the system will need to be supplemented by punch card or magnetic tape storage to enable sophisticated sorting and computing to be undertaken.