



Oil and Gas database management in China

CHEN FANGLI

Petroleum Exploration and Production Research
Institute of SINOPEC
Apr.1, 2009 · Shanghai

TOPICS

- ◆ Background of Oil & Gas activity in China
- ◆ Standard & metadata structure
- ◆ Recommendations

TOPIC --- Background of Oil & Gas activity in China

- Petroleum legislation
- Data Management Policy & Strategy
- Organizations
- Evolution of petroleum database management

Current Major Mineral Resources Laws (MRL)

Relative items of Constitution and Criminal Law of China(宪法和刑法) .	1
Mineral Resources Law of P. R. China (1996, Amendments) (矿法) .	2
Rules for Implementation of the Mineral Resources Law of the People's Republic of China(1994) (实施细则) .	3
Regulations for Registering to Explore for Mineral Resources Using the Block System (Promulgated on Feb. 12,1998) (区块办法) .	4
Regulations for Registering to Mine Mineral Resources (Promulgated on Feb. 12,1998) (采矿办法) .	5
Regulations for Transferring Exploration and Mining Rights (Promulgated on Feb. 12,1998) (转让办法)	6
Regulations of the People's Republic of China on the mining of Offshore Petroleum	7
Resources in Cooperation with Foreign Enterprises (Promulgated in 2001) (海上对外合作条例) .	8
Regulations of the People's Republic of China on the mining of Onshore Petroleum Resources in Cooperation with Foreign Enterprises (Promulgated in 2001) (陆上对外合作条例)	9
Administration Provisions Concerning the Payment of Compensation for Mineral Resources in China (Promulgated in 1994) (补偿费管理办法)	10
Interim Provisions Concerning the Payment of Resources Tax in China (Promulgated in 1993) (资源税)	11
Regulations on Administration of Geological Data (Promulgated in 2002) (地质资料汇交)	12
Other laws, regulations, rules and criterion documents related to the mineral resources.	13

Current Major Mineral Resources Laws (MRL)

Registration for exploration

Exploration licenses. The licensee have an exploration right to explore for oil and gas in the approved region.

Exploration rights are the right of exploring for mineral resources such as oil and gas in approved area.

Registration for mining

Mining licenses The licensee have an mining right to mine oil and gas in the approved region.

Mining rights are the right of mining mineral resources such as oil and gas in approved area.

Using the application method to issue an oil & gas license:
10 steps

A: Accepting

B: First-examine

C: Re-examine

D: Auditing

E: Co-auditing with related departments of MLR

F: Make a joint checkup and signed by the deputy minister of MLR

G: Issue the exploration or mining license

H: Collect the exploration or mining fee of the first year

I: Put on records

J: Bulletin

Data Management Policy & Strategy

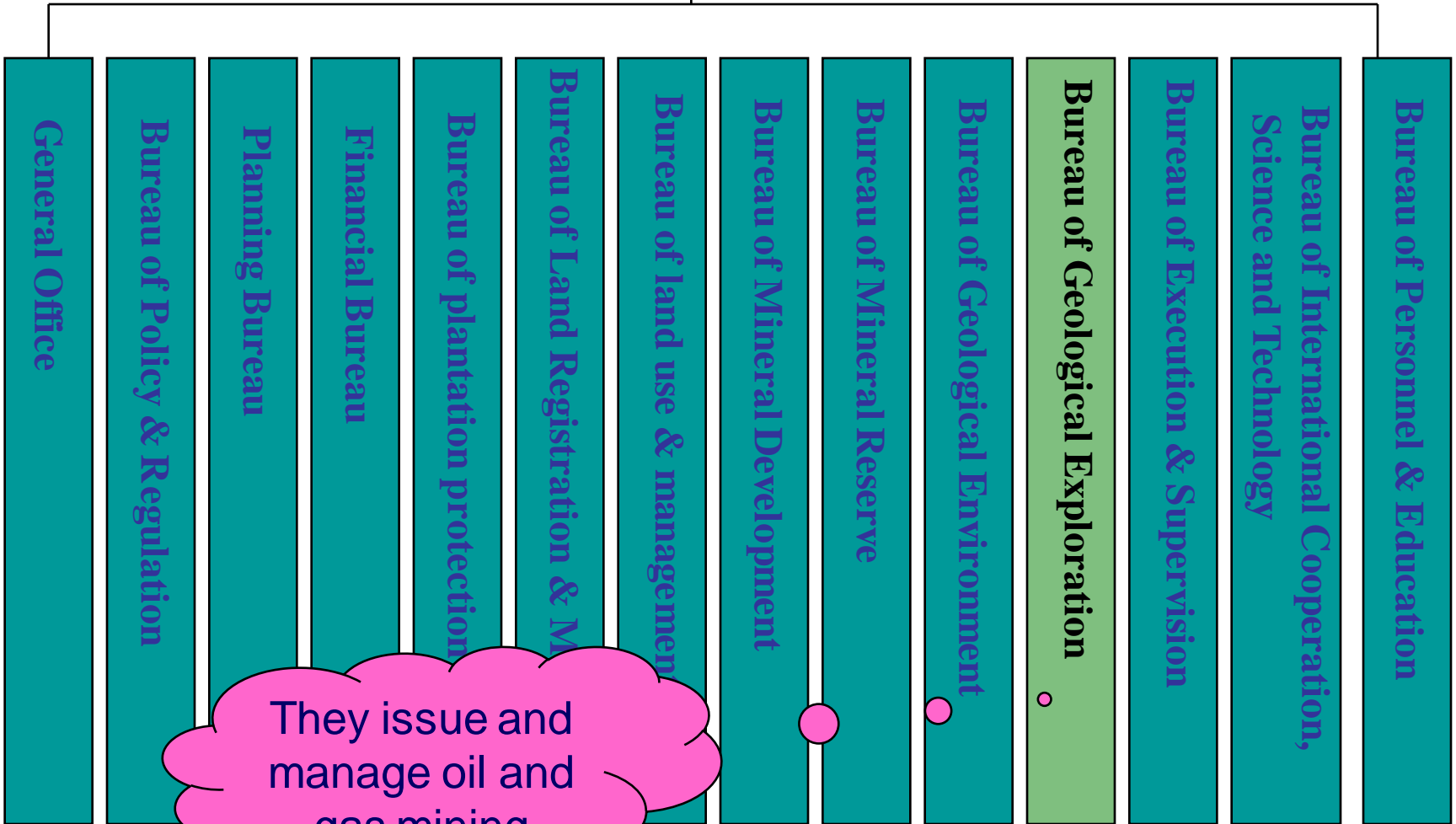
(1) Regulations on Administration of Geological Data (Promulgated in 2002)

This regulation prescribes the content of geological data, request **exploration and mining licensees to hand in** geological data in certain period.

(2) Combination of “Government administration” and “Enterprise administration”

- 1> Set special departments both in State and Provinces to manage geological data
- 2> Set geological data center in enterprises

Ministry of Lands and Resources

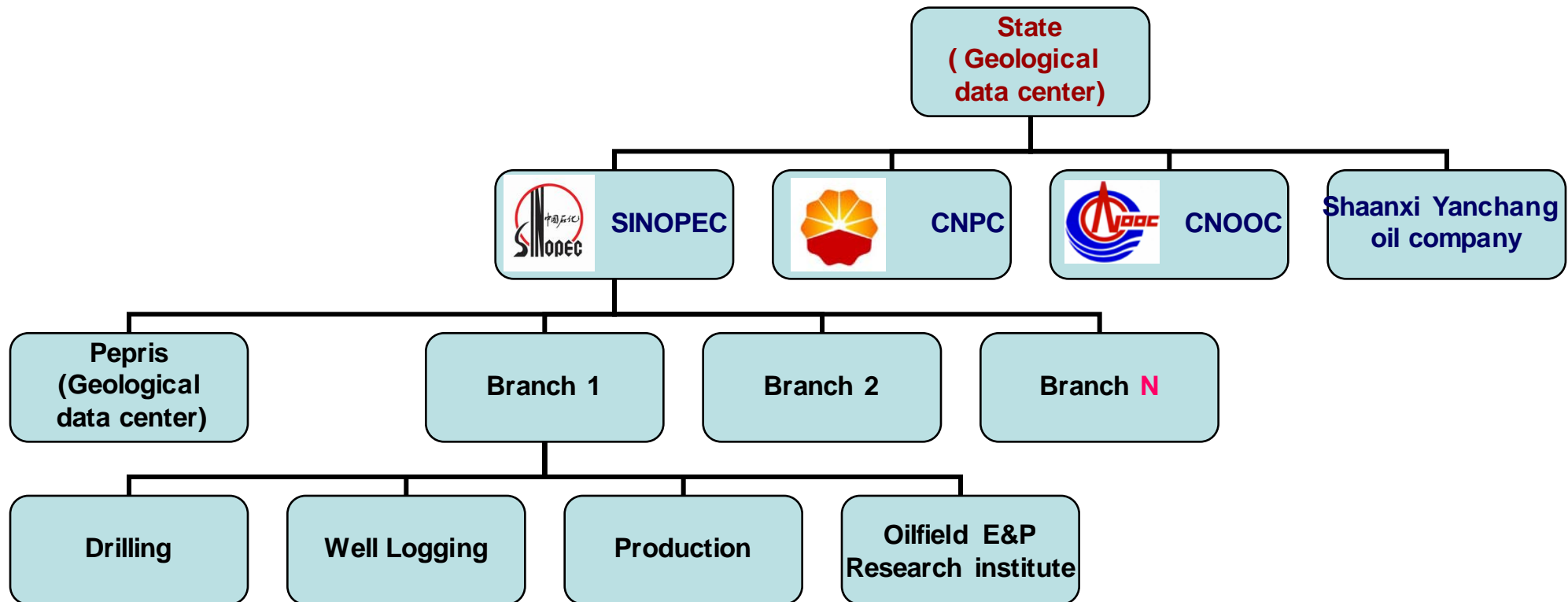


They issue and manage oil and gas mining rights

➤ Organization

Geological data Management

According to the laws and regulations, the main four oil and gas companies approved by the State Council to explore and mine oil and gas in China are CNPC (PetroChina) , SINOPEC, CNOOC and Shaanxi Yanchang oil company.



SINOPEC



- It is China's largest producer and marketer of oil products (both wholesale and retail of gasoline, diesel, jet fuel), and No.1 supplier of major petrochemical products (intermediates, synthetic resin, synthetic fiber, synthetic rubber, fertilizer).
- It's now the 16th in **Top 500 World Company**



Main business

- ◆ Exploration, development and production of crude oil and natural gas;
- ◆ Refining, transportation, storage and marketing, including import and export of crude oil and petroleum products;
- ◆ Production and sale of chemical products;
- ◆ Transmission, marketing and sale of natural gas.

➤ Evolution of petroleum database Management

Early Stage : 1990-2003

- (1) published the earliest oil & gas database standard .
 - (2) invested in technique study and training.
 - (3) encouraged branches to construct E&P database according to the standard.
- **During the past ten years, almost every oilfield of SINOPEC has established their E&P database to manage data and provide services for research and administration.**

➤ Evolution of petroleum database Management

Current Status : after 2003

Along with the rapid development of IT, the whole data management project was optimized according to new requirements.

- (1) Analyzed the data model in petroleum industry
- (2) Updated standard of data management
- (3) Tried to design a unified data management platform, to integrate the E&P database, and to enhance the Multi-Disciplinary Data Sharing

TOPICS

- ◆ Background of Oil & Gas activity in China
- ◆ Standard & metadata structure
- ◆ Recommendations

TOPIC --- Standard & metadata structure

- Metadata design & structure
- International standard used
- System & technologies used
- Data flow & access
- Challenges to national database management
- Future plans to improve database management

Many kinds of data need to be managed:

Data Type	Content		Store Method	location
Structural data	data		database	Oracle
	metadata			
Nonstructural data	Document, Picture, Bulk data, drill core	data	CD, tape ,film ,paper	Shelf
			tape	ATM, shelf
			Digital file	Hard disk
	metadata	table	Oracle	
GIS data	Usually used	data	database	Oracle Spatial
		metadata	database	Oracle
	Unusually used	data	Digital file	Hard disk
		metadata	database	Oracle

We have ranged them into three groups :

- (1) E&P data
- (2) GIS data
- (3) Archival data

Wellbore data
Bulk data
Production data
Facilities data

POSC EPICENTRE

Geological archival data
Multi-media data
Books & periodicals
Other un-structured data

Dublin Core

GIS data
Basin data
Geological map
Image data, etc.

ISO 19115

➤ E&P metadata design

We analyze the

POSC EPICENTRE
Meta Model

**35 logical entities
of the metadata
to describe how a
logical data model
was projected to
create the
corresponding
Relational
Implementation**

abbreviation
att_col_grp_map
attribute
change
change_request
changed_object
column_def
column_group
ddl_tuning
description
diagram_set
duplication
entity_def
enum_type
enum_value
epic_type
obj_desc
prod_versn

projection_map
ref_column_grp
ref_dupl_method
ref_feature
ref_object
ref_proj_method
ref_rule_type
ref_schema
rules
schema_def
select_type
source
sql_type
supersub
table_def
type_def
use_stats

We design our E&P database metadata based on POSC Epicentre Metadata model

number	ChineseName	EnglishName	describe	type	length	Is Key	Not
1	表名	Tablename		Char	50 **	Y	Y
2	变化字段名	ColumnName		char	20	Y	Y
3	变化类型	ChangeType	Insert,delete,update	Char	10		
4	变前长度	LengthBeforeChange		Char	8		
5	变后长度	LengthAfterChange		Char	8		
6	变前类型	TypeBeforeChange		Char	20		
7	变后类型	TypeAfterChange		Char	20		
8	变前是否允许空	NullBeforeChange		Char	2		
9	变后是否允许空	NullAfterChange		char	2		
10	变化时间	ChangeTime		Char	20	Y	Y
11	改变人	ChangeDBA		Char	50		

This is an example!

change

A subset of metadata: metadata about data table

number	ChineseName	EnglishName	describe	type	length	Is Key	Not
1	关系名	RelationCaption	Relation name	Char	100	Y	Y
2	涉及表名	RelatedTableName	Table name involved	Char	200		
3	关系表达式	RelationExpression	Relation express	Char	200		

relation

number	ChineseName	EnglishName	describe	type	length	Is Key	Not
1	表名	TableName		Char	50	Y	Y
2	序号	ColumnNumberInTable		Char	5		Y
3	字段名	ColumnName		Char	50	Y	Y
4	字段标题	ColumnCaption		char	50		
5	类型	ColumnType		Char	20		
6	长度	ColumnLength		Char	8		
7	是否关键字	ISKey **		Char	2		
8	是否允许空	IsNull		Char	2		

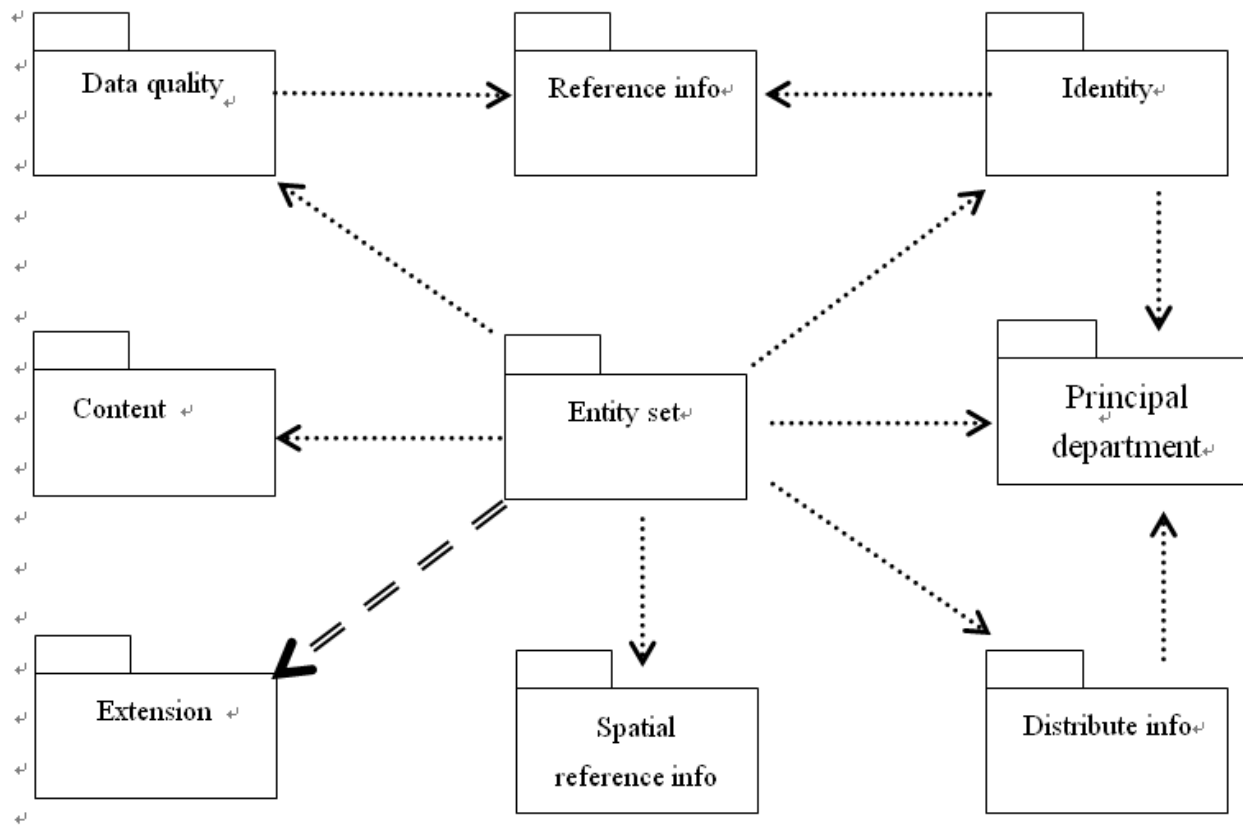
Table attributes

The subset of metadata help us to monitor the data table

➤ GIS metadata design (ISO 19115)

GIS metadatas involve kinds of geology object, and related data type.

This is a concept diagram of GIS metadata structure. Every metadata includes one or more entities and elements.



concept diagram of GIS metadata structure

We apply ISO19115 to design our GIS metadata

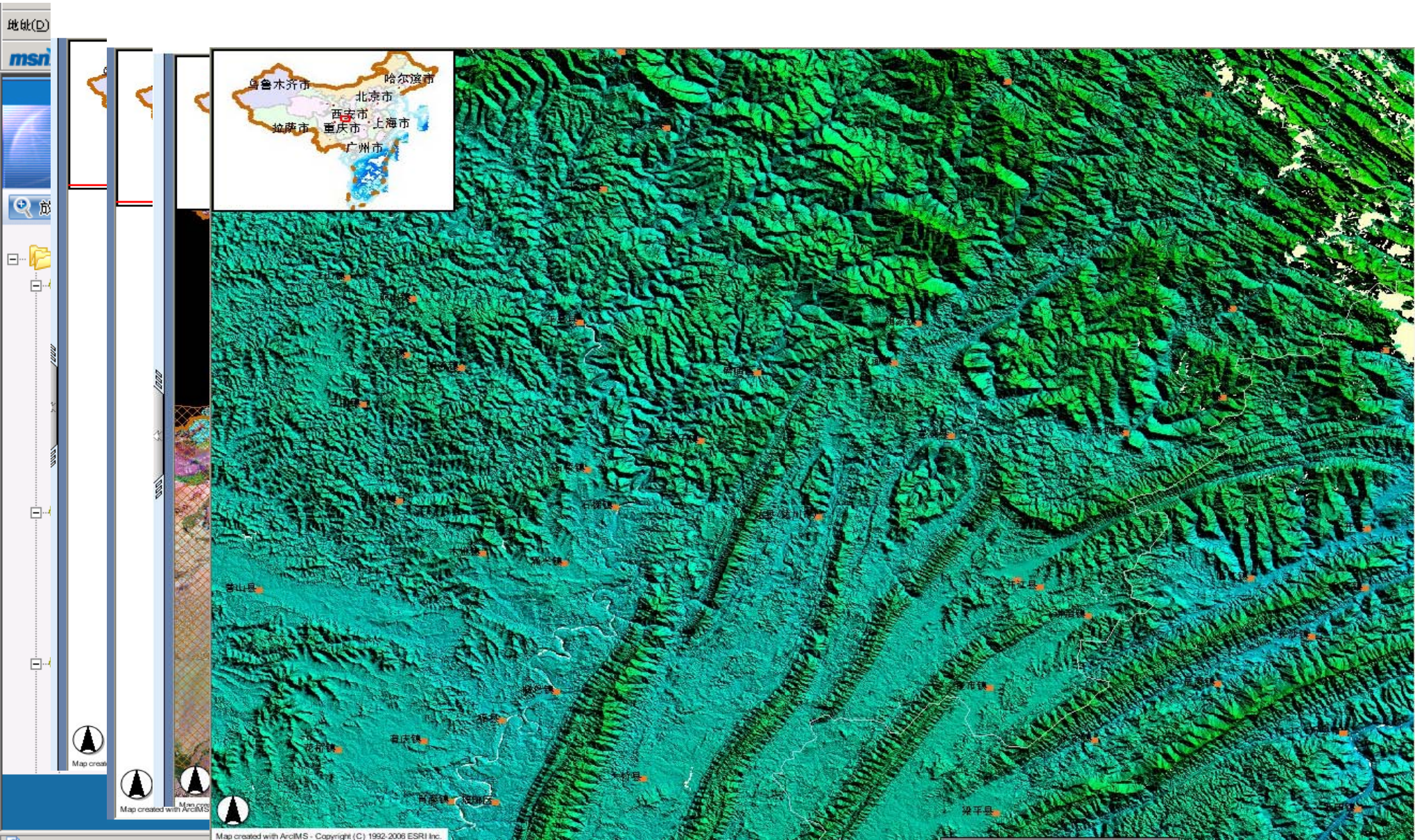
➤ GIS metadata design

Information of metadata (MD_metadata) ↕

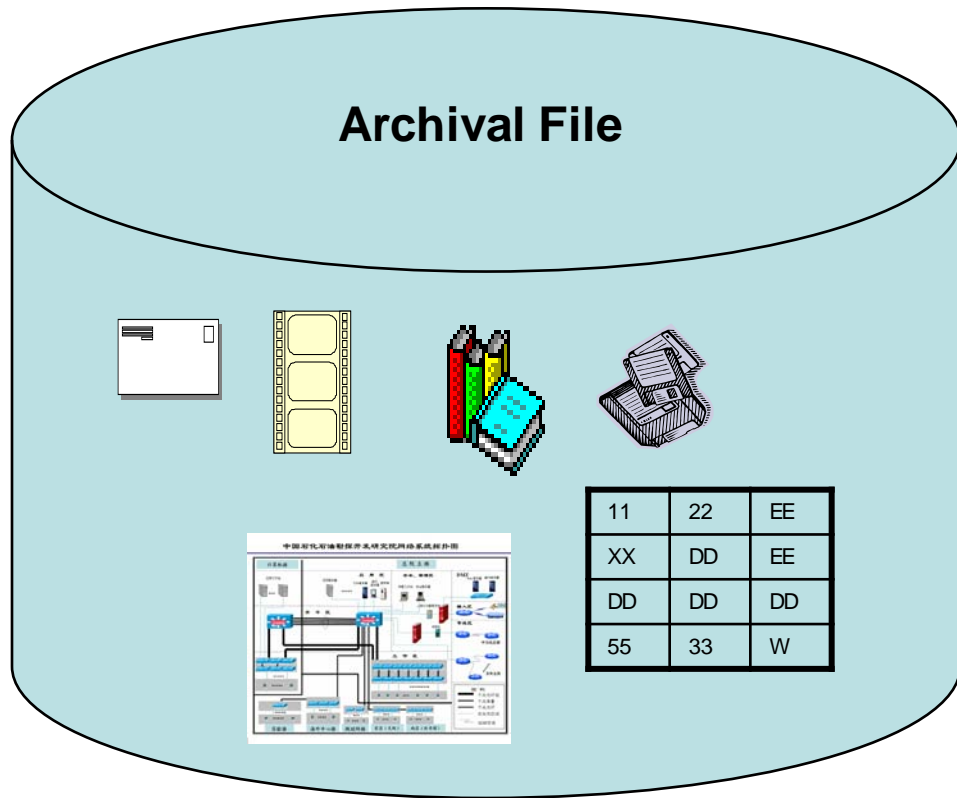
sequence number↕	EntityName↕	Element name↕ Chinese↕	Element name↕ English ↕	English abbr.↕	Defination↕	Constraint↕	Present times↕	Data type↕	Value region↕
1.1↕	MD_metadata↕	↕	MD_Metadata↕	Metadata↕	Root entity to define certain data setor data sourc ↕	M↕	1↕	Class↕	1.1.1-1.1.11↕
1.1.1↕	↕	元数据名称↕	metadataTitle↕	mdTitle↕	title↕	O↕	1↕	String↕	text↕
1.1.2↕	↕	元数据创建日期↕	dataStamp↕	mdDataSt↕	audit date↕	M↕	1↕	date↕	CCYYMMDD GB/T 7408-1994 ↕
1.1.3↕		语种↕	language↕	mdLang↕	language↕	O↕	N↕	String↕	Chinese,English↕
1.1.4↕		字符集↕	characterSet↕	mdChar↕	character set standard↕	O↕	1↕	Class↕	MD_character set A.1 ↕
1.1.5↕		元数据标准名称↕	metadataStandardName↕	mdStanName↕	Standard used↕	O↕	1↕	String↕	text↕
1.1.6↕		元数据标准版本↕	metadataStandardVersion↕	mdStanVer↕	Version number of Standard used↕	O↕	1↕	String↕	text↕
1.1.7↕		联系单位↕	contact↕	mdContact↕	Department or person with responsibility for metadata↕	M↕	N↕	Class↕	CI_Principal department↕
1.1.8↕		角色名: 标识信息↕	identificationInfo↕	dataIdInfo↕	Basis info to describe geological dataset ↕	M↕	1↕	Class↕	MD_identity↕
1.1.9↕		角色名: 数据质量信息↕	dataQualityInfo↕	dqInfo↕	Evaluate of data quality↕	M↕	1↕	Class↕	DQ_data quality↕
1.1.10↕		角色名: 空间参照系信息↕	referenceSystemInfo↕	refSysInfo↕	spatial reference system of metadata↕	C/空间数据↕	1↕	Class↕	RS_spatial reference system↕
1.1.11↕		角色名: 内容信息↕	contentInfo↕	conInfo↕	Content of metadata↕	M↕	N↕	Class↕	MD_content description↕
1.1.12↕		角色名: 分发信息↕	distributionInfo↕	distInfo↕	Info about distribute or method to retrieve the product info ↕	O↕	1↕	Class↕	MD_distribute↕

This is our metadata table

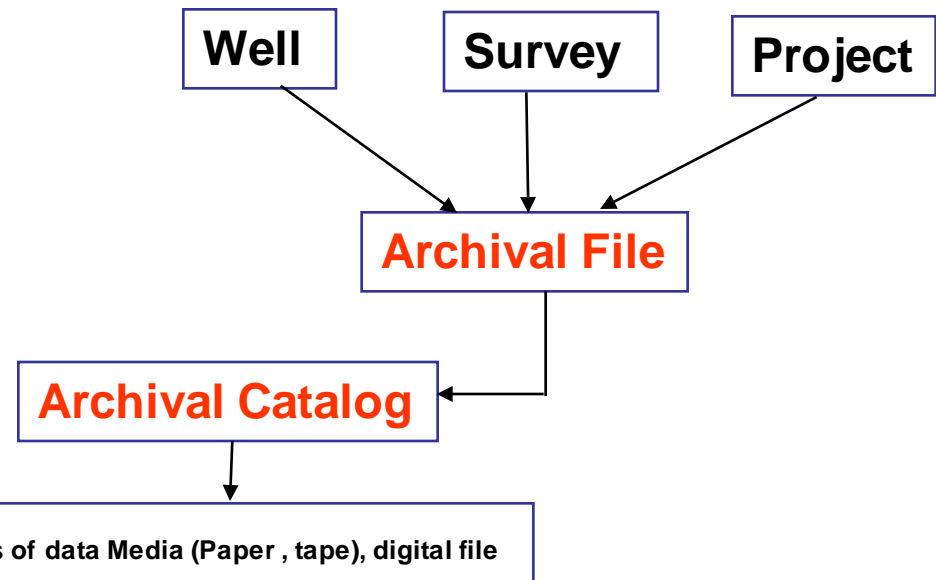
Case system- Geology and Geography database of SINOPEC



➤ Archival metadata design



An archival file includes all the data built during the whole E&P process of a well, a survey, or a research project.



This figure shows the parts of archival file

➤ Archival metadata design

Archival File 

Metadata group	Element
Title	Archival Code
	Sister Code
	Digital Code
	Abstract
	Keyword
	Title
	Alternate name
File Content and location	Archives room
	Storage Location
	Count of File Boxes
	Length of File Boxe
	Paper Copies
	Sets of Disc Copies
	Pieces of disc
	Disc Location

Metadata group	Element
Project Source	Project ID
	Survey ID
	Well ID
	Well Type
	Sub company mark
Coverage	Administrative Division
	Geology Construct
	Coordinate System Type
	Geodetic Reference System
	Coordinates

Metadata group	Element
Creator	Creator
	Contributor
	Source
	Description Person
Date	Created date
	submit Date
	Description Date
	Auditor date
Audit	Auditor
	Auditor conclusion

Protect	Secret degree
	Retention Period
	Protect Period
	Circulation range

The metadata help us to describe the archival data



CCOP

Coordinating Committee for Geoscience Programmes
in East and Southeast Asia

➤ Archival metadata design

Archival Security

Archival Code
InFileNumber
NewArchivalCode
SecurityThings
NewSecurityLevel
ProtectPeriod
StartDate
OldSecurity
SecurityType
IsProtectedByEnterprise
SecurityPage
PictureNumber
LevelScale
VerticalScale

Archival Protection

ProtectionRegisterNumber
GatherDataListNumber
InListNumber
DataName
ProtectType
ProtectStartDate
ProtectEndDate
ProtectApplyDate
RegisterDate
Handler
HandlerOpinion
Auditer
AuditOpinion
Subscriber
SubscriberOpinion
SubscribeDate

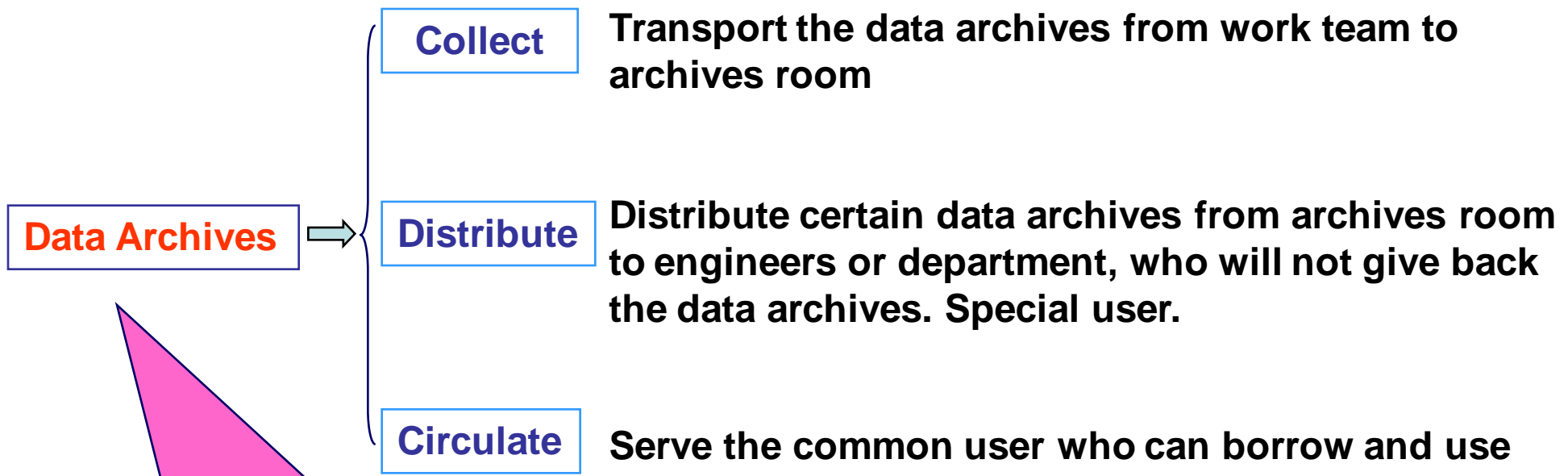
Archival Quality

Archival Code
Archive Date
Archival Quality Desc
Quality Evaluator

These are Metadata for Archival Security , Protection and Quality

➤ Archival metadata design

Other events that metadata should record in database



We extended DC standard

Case system----GeoAsset

Geological data management system

地质资料著录归档系统

案卷管理(A) 数据导入导出

地质资料著录归档系统 - [案卷登记]

案卷管理(A) 数据导入导出

案卷登记 xml导入 数据导出 档号管理

文件著录

档号	卷内编号	资料名称	编制单位	作者	文档类别	文件序号	每份件数	份数
GK0002	1	阿尔及利亚GU...	中国石化江汉...	陈红, 艾献明	报告	报告	1	1
GK0002	2	阿尔及利亚GU...	中国石化江汉...	谢洪光	附图	报告的附图1	1	1
GK0002	3	阿尔及利亚GU...	中国石化江汉...	谢洪光	附图	报告的附图2	1	1
GK0002	4	阿尔及利亚GU...	中国石化江汉...	谢洪光	附图	报告的附图3	1	1
GK0002	5	阿尔及利亚GU...	中国石化江汉...	谢洪光	附图	报告的附图4	1	1
GK0002	6	阿尔及利亚GU...	中国石化江汉...	谢洪光	附图	报告的附图5	1	1

当前工作分库: 国勘库-原本

档号: GK0002

案卷名称: 阿尔及利亚GUERA

上交单位: 中国石化国际勘探

编制单位: 中国石化江汉油田分

编写者: 陈红, 艾献明

项目信息

项目来源: 中国石化集团国际

井

井名:

地震工区

工区:

保密保护

密级: 内部

卷内载体量

总件数: 8 内物件数: 8

纸介质盒数: 1 纸介质套: 1

光盘张数: 1 光盘套: 1

地理坐标

行政区划: 阿尔及利亚

构造位置: 撒哈拉地台(韦德迈)

坐标类型: 经纬度

Xmin: 0

南端纬度:

内容简介

关键词: 三叠盆地, 圈闭评价

摘要: 本项目是江汉石油... 项目以圈闭评价技术... 对区内地质、地层结...

附注:

档号: GK0002 卷内编号: 1 分类: 地 是否参与检索 种: 成果报告

题名: 阿尔及利亚GUERARA合同区圈闭评价与目标优选

交替题名:

比例尺: 线号:

井段:

编制单位: 中国石化江汉油田分公司勘探开发研究院, SIPC阿尔及利亚GUERARA项目部

编写者: 陈红, 艾献明 编制时间: 20060301

关键字: 三叠盆地, 圈闭评价, 经济评价

摘要: 项目以圈闭评价技术规范 and PSC条款为依据, 按照项目地质任务的要求, 以构造地质和油气成藏地质学理论为指导, 通过分析区内钻井、测试资料以及邻区内地质、地层结构研究, 完成了近5000km²的地震资料解释, 开展了圈闭识别和可靠性评价。发现了四个北东向圈闭聚集带, 其中阿古圈闭发育带圈闭条件良好, 储集条件、时空配置等成藏地质条件优越, 综合评价为1类区。开展了地质风险评价, 评价出四个II类圈闭, 其中1-1圈闭地质评价系数最高, 地质风险最小。

文件类别: 报告 文件序号: 报告 语种: 汉语 国别: 中国 印制方法: 胶印

件数: 1 份数: 1 页数: 61 纸介质规格: A4 第几盒: 1 介质登记: *

附注:

电子文件:

存储位置:

删除文件:

著录时间: 20070622 著录人: 徐虹 涉密登记:

上传进度:

新建 插入 保存 删除 文件卡片 样式 案卷盒目录 留存登记 选择互建文件 上移 下移 退出 帮助

Case system----GeoAsset

Geological data management system

附表 6	井楼油田高庄区块勘探开发工作量统计表	60
附表 7	井楼油田高庄区块钻井基础数据表	69
附表 8	井楼油田高庄区块钻井取芯及岩芯分析统计报表	70
附表 9	井楼油田高庄区块分析化验工作量统计表	71
附表 10	井楼油田高庄区块有效厚度岩性、含油性、物性界限基础数据表	72
附表 11	井楼油田高庄区块有效厚度电性界限基础数据表	73
附表 12	井楼油田高庄区块岩芯分析与解释孔隙度关系基础数据表	74
附表 13	井楼油田高庄区块石油储量数据表	76
附表 14	井楼油田高庄区块石油储量综合评价表	76
附表 16-1	高庄区块未来投资估算表开发	77
附表 16-2	(1) 高庄区块南部生产成本费用预算表	78
附表 16-2	(2) 高庄区块北部生产成本费用预算表	79
附表 16-3	经济参数表	80
附图 1	井楼油田高庄区块地理位置图	81
附图 2-1	南阳凹陷油气勘探许可证与登记位置图	82
附图 2-2	唐河低凸起油气勘探许可证与登记位置图	83
附图 2-3	南阳凹陷井楼油田石油采矿许可证	84
附图 3	高庄区块新增探明储量含油面积图	86
附图 4	井楼油田高庄区块新增探明储量综合图	86
附图 6	井楼油田高庄区块构造位置图	87
附图 6	高庄 5 井人工合成记录标准剖面	88
附图 7	高庄区块三段V油组层面构造图	89
附图 8-1	高庄区块过流 6109 井—高庄 5 井—高庄 15 井 AA' 地震剖面	90
附图 8-2	高庄区块过流 27 井 CC' 地震剖面	91
附图 8-3	高庄区块过流 11—高庄 16 井 CC' 地震剖面	92
附图 8-4	高庄区块过流 10—高庄 15 井 CC' 地震剖面	92
附图 8-5	高庄区块过流 20 井—高庄 15 井 CC' 地震剖面	94
附图 8-6	高庄区块过流 5 井 CC' 地震剖面	95
附图 8-7	高庄区块过流 15 井 CC' 地震剖面	96
附图 8-8	高庄区块过流 11 井—高庄 27 井 CC' 地震剖面	97
附图 8-9	高庄区块过流 12 井—高庄 10 井—高庄 16 井 II' 地震剖面	98
附图 9-1	高庄区块过流 6109 井—高庄 5 井 N2IV、N2V 油组地层对比图	99
附图 9-2	高庄区块过流 16 井—高庄 15 井 N2IV、V 油组地层对比图	100
附图 10	高庄区块 IV 油组底部标志层对比图	101

Retrieve result



TOPIC --- Standard & metadata structure

- Metadata design & structure
- International standard used
- System & technologies used
- Data flow & access
- Challenges to national database management
- Future plans to improve database management

International standard used

- Dublin Core Metadata: expanded
- ISO/19115 Metadata : GIS applied
- POSC Meta model : reference

TOPIC --- Standard & metadata structure

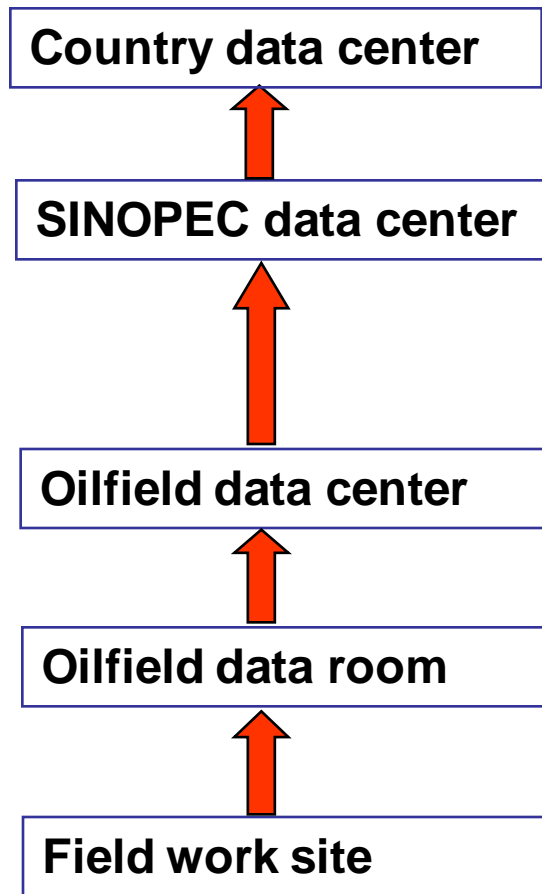
- Metadata design & structure
- International standard used
- System & technologies used
- Data flow & access
- Challenges to national database management
- Future plans to improve database management

System & technologies used

Operation System	Database system & GIS system	Software develop tool	Desktop tool
Unix	Oracle	Microsoft VS. NET	Microsoft Office
Linux	Sql Server	Java	
AIX	ArcInfo	Delphi	
Windows 2003 server	MapInfo		
Windows XP	Access		
	Visual Foxpro		
Etc.	Etc.	Etc.	Etc.

TOPIC --- Standard & metadata structure

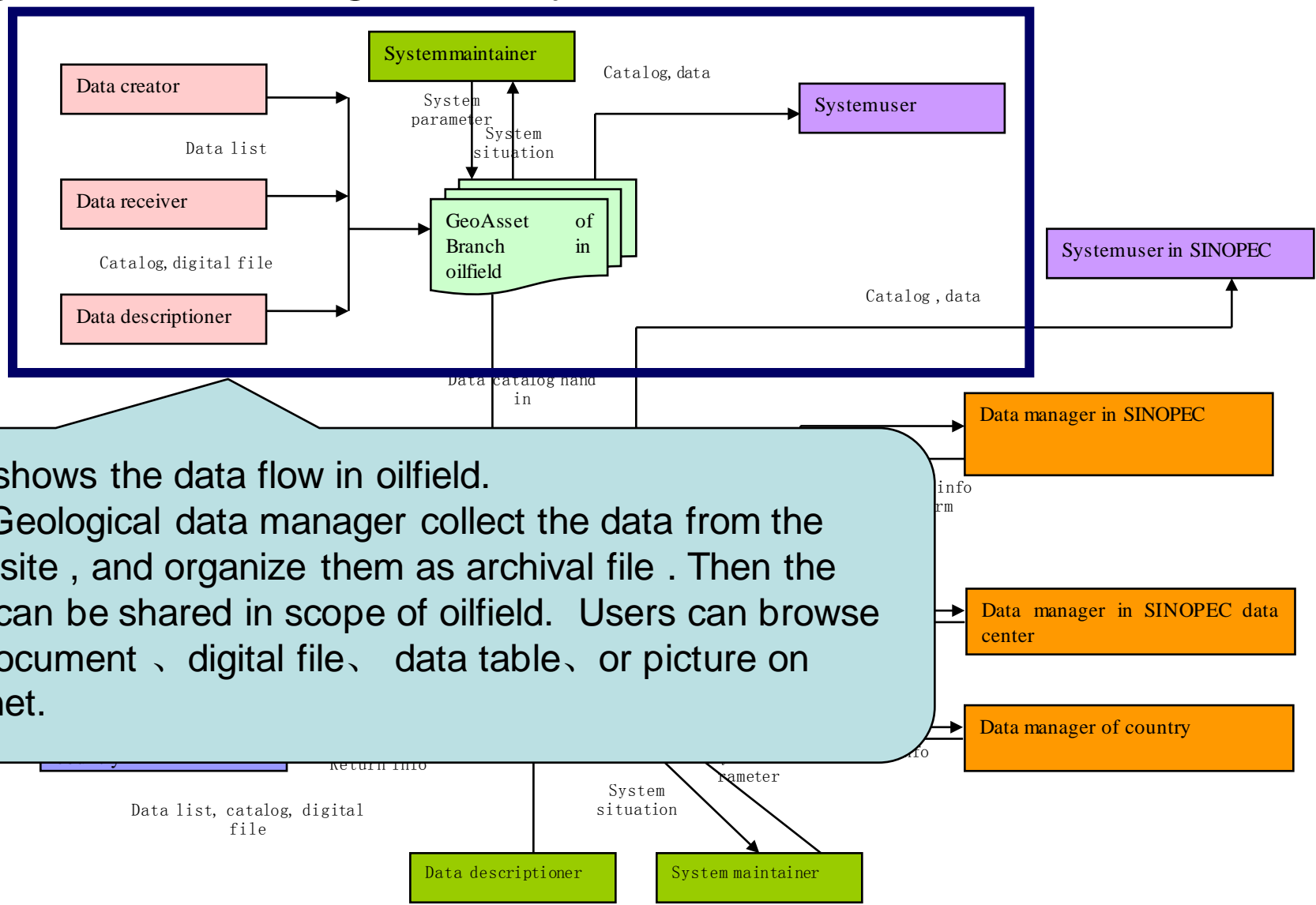
- Metadata design & structure
- International standard used
- System & technologies used
- Data flow & access
- Challenges to national database management
- Future plans to improve database management



Data Flow

- (1) There are more than 140 data management departments in SINOPEC, All the data manage departments form a huge network.
- (2) Data management departments have to collect papers, pictures, the wellbores, tapes and so on in time everyday. And range them clearly and logically. Engineers can use the data quickly.
- (3) According to the regulation, some certain data must be transferred to Country data center.

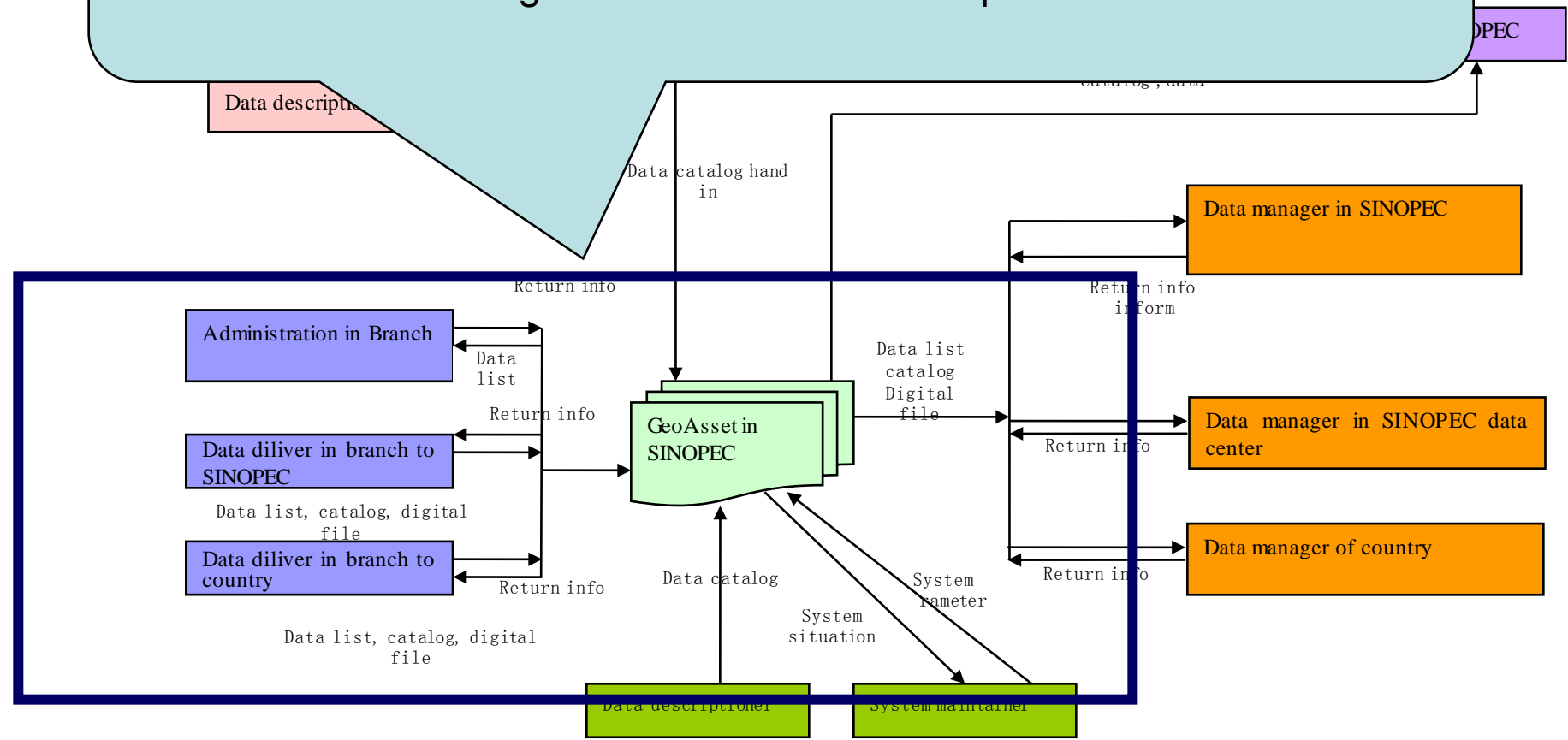
Geological data management system-GeoAsset



This shows the data flow in oilfield. The Geological data manager collect the data from the work site , and organize them as archival file . Then the data can be shared in scope of oilfield. Users can browse the document 、 digital file、 data table、 or picture on intranet.

Geological data management system

This shows the data flow in SINOPEC headquarter .The Geological data manager receive the data from oilfield, and reorganize them. Then the data can be shared in scope of whole SINOPEC. Users can browse the the document 、 digital file、 data table、 or picture on intranet.



TOPIC --- Standard & metadata structure

- Metadata design & structure
- International standard used
- System & technologies used
- Data flow & access
- Challenges to national database management
- Future plans to improve database management

➤ Challenges to data management

- (1) The situation of every branches in oilfield is quite different. The data standard varies too. It's a huge project to unify the data standard and design a big new system as E&P data center.**
- (2) A large amount of data in every branches need a scientific and safe backup Strategy.**

A well-designed E&P data center system will be the best solution for keeping the company's asset.

TOPIC --- Standard & metadata structure

- Metadata design & structure
- International standard used
- System & technologies used
- Data flow & access
- Challenges to your national database management
- Future plans to improve database management

➤ plan to improve database management

(1) The call of “six unified” to IT department in SINOPEC ,is also apply to oil & gas data management project.

**“unified layout
unified standard
unified design
unified investing
unified constructing
unified management”**

(2) Based on the existed database , a unified data management platform should be designed to integrate the old E&P database and update the situation of data management, so as to enhance the Multi-Disciplinary Data Sharing.

TOPICS

- ◆ Background of Oil & Gas activity in China
- ◆ Standard & metadata structure
- ◆ Recommendations

➤ **Required capacities to be developed by the member countries**

- (1) The ability to understand the standard for CCOP**
- (2) A set of methodology about data management**
- (3) Specialists who can help other countries to construct database**
- (4) Have a case project for other countries to study**

➤ **Recommendation about knowledge sharing in SINOPEC**

We can choose a project to conduct experiments, to test the research result and show the practicality. After this, we can popularize to more area, or give some suggestions.

➤ Recommendation about CCOP natural gas metadata design

- (1) Natural gas data should be in this table, metadata of E&P can work too.
- (2) Focus on that the E&P process of Natural Gas is special .
- (3) Static data and Dynamic data is also different .

Data Type	Content		Store Method	location
Structure data	data		database	Static
	metadata			Dynamic
Nonstructural data	Document, Picture, Bulk data, drill core	data	CD, tape ,film ,paper	shelf
			tape	ATM, shelf
			Digital file	Hard disk
	metadata	table	Oracle	
GIS data	Usually used	data	database	Oracle Spatial
		metadata	database	Oracle
	Unusually used	data	Digital file	Hard disk
		metadata	database	Oracle

➤ Recommendation about CCOP natural gas metadata design

(1) Using “7W rule” to analyze the natural gas activity

we need to describe all the activities and attributes about natural gas.
who when where which why how what

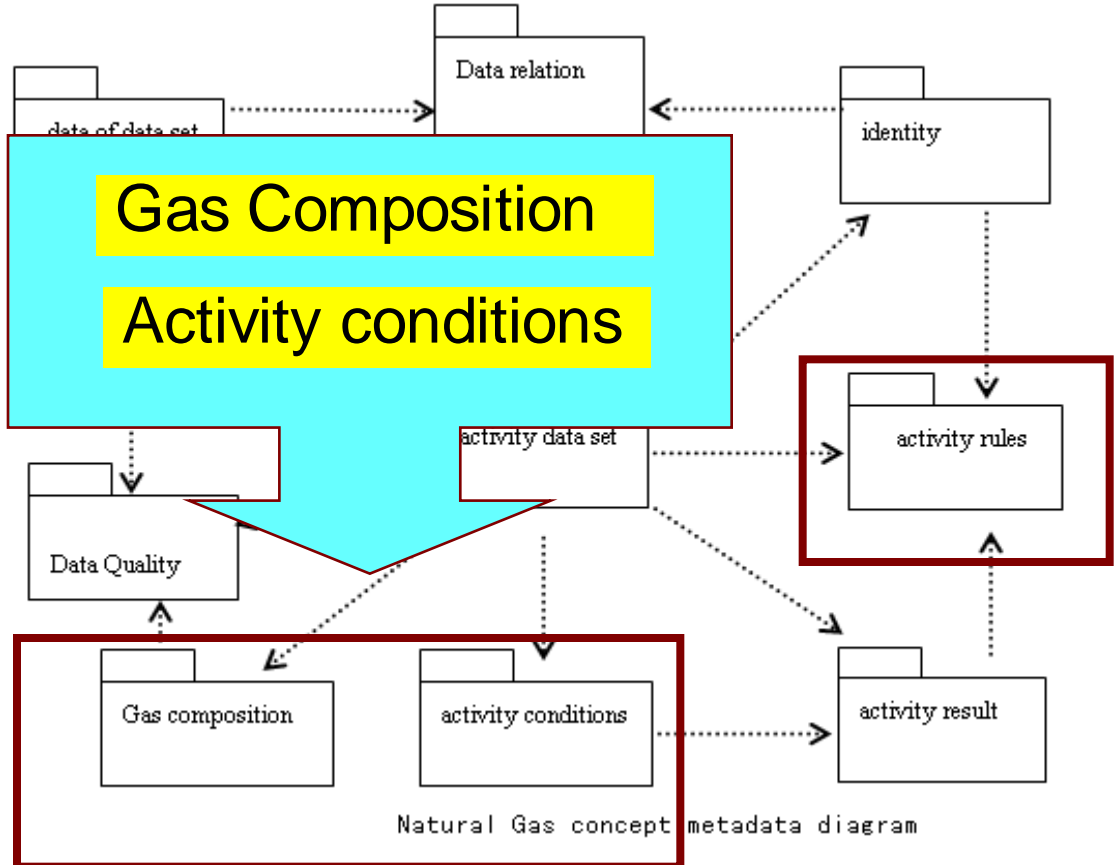
If we answer this 7 questions, we can know how the natural gas data is created, on what condition, and what the result should be.

Activity name	who	when	Where	Which	why	what	how
Analysis of output Composition	Technician	2009-3-21 12:30	Laboratory	Gas field	Give timely measurement to decrease the output decline	Keep on knowing the composition of output	According to the changes of output
Activity describe	According to the changes of output, Analysis the natural decline of the certain gas field, Keep on knowing the composition of output, Give timely measurement to decrease the output decline						

➤ Recommendation about CCOP natural gas metadata design

(2) Using metadata to describe activity data set

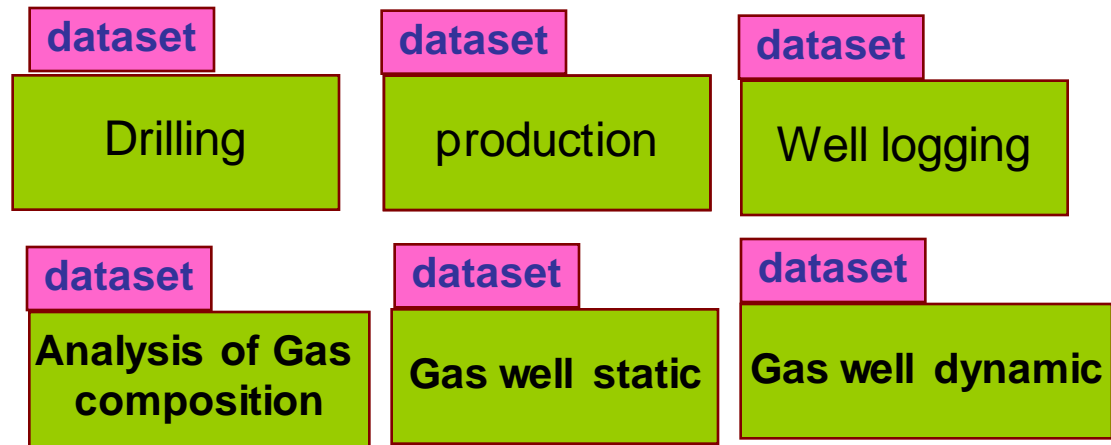
Same to the concept of GIS data set , activity creates data sets of natural gas. Maybe the natural gas metadata diagram should be extended as follow:



Compare to the metadata of GIS, The natural gas metadata will be very different. Maybe the Gas composition , the condition of process, the rules of operation will impact to the data result.

◆ NEXT

1) There will be



2) Metadata should record:

Conditions of activity

Parameters of process

Formula of sum total

Rules of data integration

Relations between dynamic and static data

Etc.



Thanks!