



PETROLEUM
GEOLOGY
OF 中国石油地质
CHINA 四川盆地
SICHUAN BASIN

富饒的盆地	光輝的歷史	8	— 前 言
得天獨厚	絢麗多姿	22	— 地 理 篇
盆地形成	歷經滄桑	52	— 地 史 篇
裂縫滲濾	縫洞並存	102	— 氣 田 篇
艱苦探索	科學結晶	136	— 工 藝 篇
資源豐富	前景廣闊	150	— 展 望 篇

Preface — 8	BEAUTIFULY AND RICHLY ENDOWED BASIN, GLORIOUS AND MAGNIFICENT HISTORY
Geography — 22	GORGEOUS BEAUTY ENDOWED BY NATURE
Geological history — 52	FORMATION OF BASIN OVER GEOLOGICAL EVENTS
Occurrence of gas reservoirs — 102	FRACTURES AND CAVITIES IN ROCKS
Science and technology — 136	ACHIEVEMENTS THROUGH HARD PURSUIT
Prospects — 150	RICH RESOURCES, BRIGHT FUTURE

中國石油地質

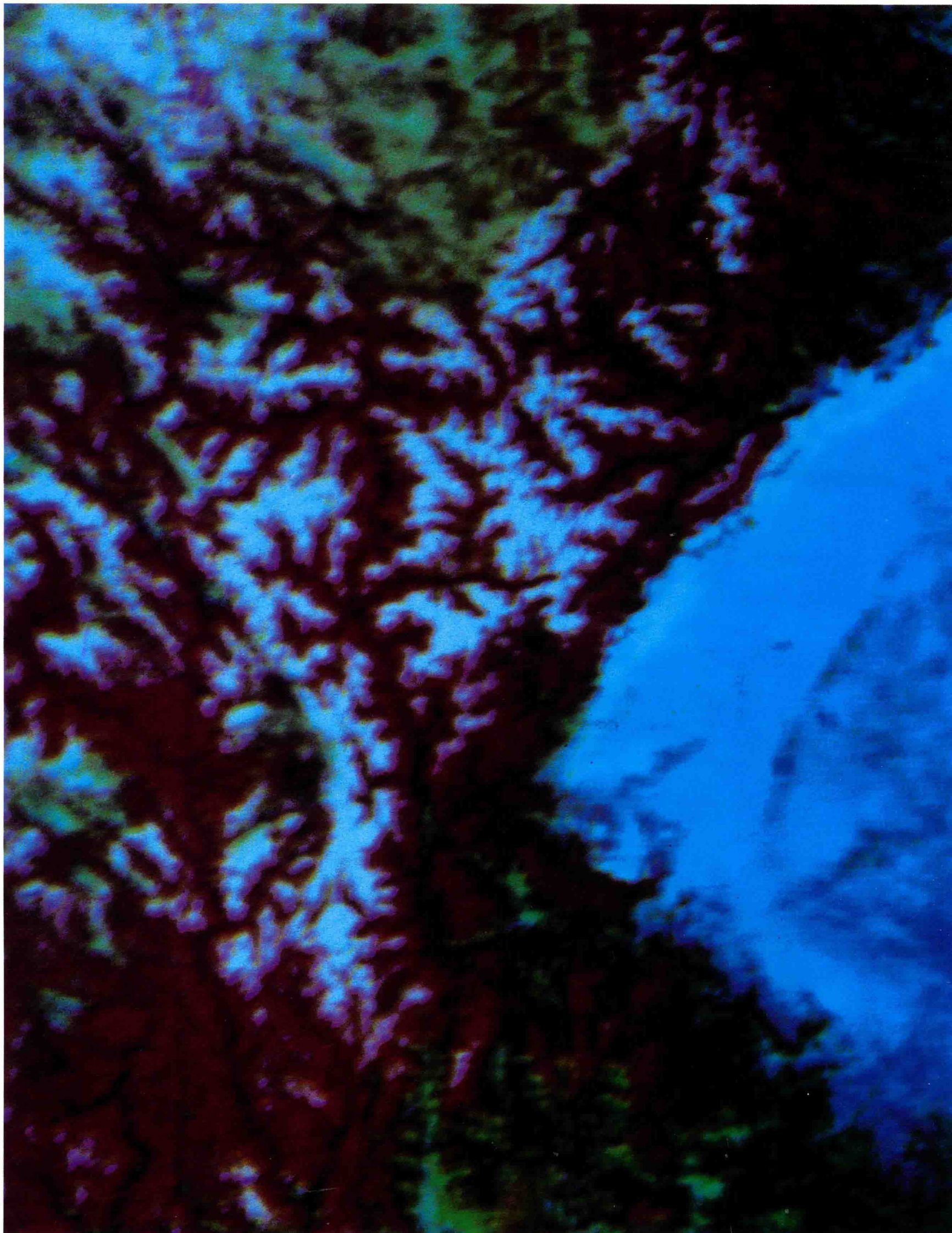
閻聚寬



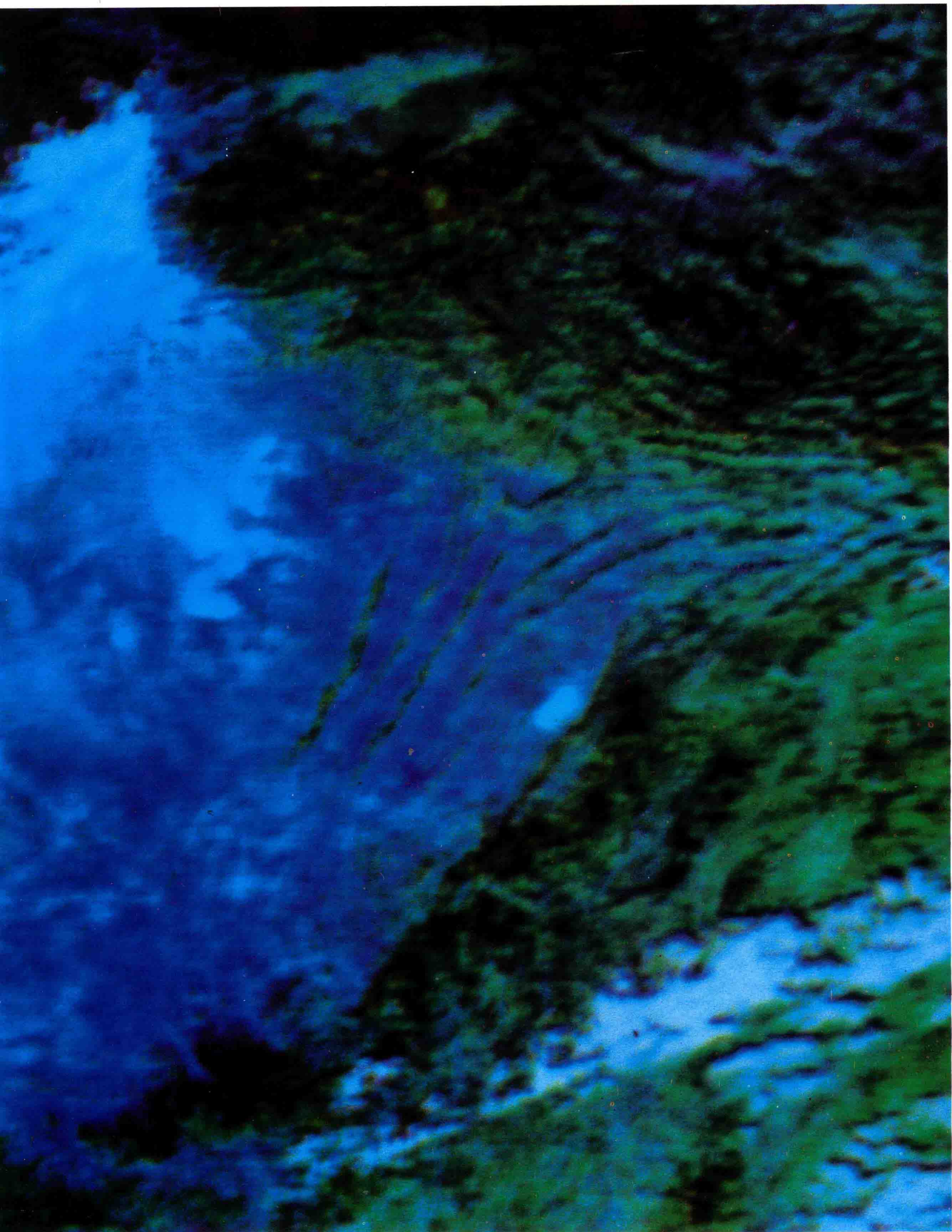
PETROLEUM
GEOLOGY

OF 中國石油地質

CHINA 四川盆地
SICHUAN BASIN



從“風雲一號”衛星上看四川盆地
LOOK SICHUAN BASIN FROM SATELLITE



富饒的盆地	光輝的歷史	8	— 前 言
得天獨厚	絢麗多姿	22	— 地 理 篇
盆地形成	歷經滄桑	52	— 地 史 篇
裂縫滲濾	縫洞並存	102	— 氣 田 篇
艱苦探索	科學結晶	136	— 工 藝 篇
資源豐富	前景廣闊	150	— 展 望 篇

Preface — 8	BEAUTIFULY AND RICHLY ENDOWED BASIN, GLORIOUS AND MAGNIFICENT HISTORY
Geography — 22	GORGEOUS BEAUTY ENDOWED BY NATURE
Geological history — 52	FORMATION OF BASIN OVER GEOLOGICAL EVENTS
Occurrence of gas reservoirs — 102	FRACTURES AND CAVITIES IN ROCKS
Science and technology — 136	ACHIEVEMENTS THROUGH HARD PURSUIT
Prospects — 150	RICH RESOURCES, BRIGHT FUTURE

富饒的盆地 光輝的歷史

前言

四川盆地在中國幾個大盆地中具有悠久的油氣勘探史、富饒的礦產和秀麗多姿的山川地貌。它，好似一顆璀璨絢麗的明珠鑲嵌在祖國的大西南。在這裏，不僅僅只有峨眉“佛光”、青城“神燈”、九寨“童話”、三峽“神奇”，也不只有川酒的醇香、川味的奇特、川腔的詼諧和川韻的綿長。我們專注的目光將穿過億萬年沉積地層的深邃，去探尋和研究盆地中蘊藏的豐富的油氣寶藏。

隨着鏡頭的推移，畫頁的飄動，讓我們共同翻開一頁頁地層這部巨厚的地質史卷，看看四川盆地的昨天和今天，了解盆地地下構造的千姿百態和縫、洞組成的神奇世界，去開發儲存在縫洞中雄厚的油氣資源。

兩千年前，我們的祖先在臨邛（今邛崃）開鑿的火井的光焰，輝耀過古老的中國大地。世界上第一口天然氣氣井，人類開發利用天然氣的歷史功績將永記於世界石油史冊。

150年前，在自流井氣田上的“榮海井”開創了世界上第一口超過千米的深井紀錄，隨後日產天然氣百餘萬方的“磨子井”又開鑿成功。現在它們發黃變黑的高大木製天車，依然聳立在氣田上空。它們，既讓我們感到祖先的聰慧與偉大，又使我們感到重負在身。

歲月悠悠，天地回游。

新世紀的地質錘執著地敲打，創業者們堅定的步伐，掀起了全盆地18萬平方公里油氣勘探的熱潮。我們奮鬥、我們探索，不斷研究——30

年代、40年代、50年代……一部揭示碳酸鹽岩裂縫性氣藏奧秘的四川盆地天然氣勘探開發史，凝結着幾代石油工作者的心血和艱難歷程。

從巴縣石油溝氣井的噴鳴到川南氣區的勘探，從川中龍女寺噴油到拿下威遠大氣田，從二、三疊系產氣到石炭系氣層的發現等等，每一段歷程，每一項成果，認識的逐步深化，勘探領域的擴大，都不無艱辛。在勘探的征途上所付出的辛勤勞動，得到的是無愧於時代的重托和四川天然氣工業的成長發展。

四川盆地，有中國最深的（7078米）鑽井紀錄；有中國第一口水平鑽井；有對付裂縫性氣藏勘探開發的系列工藝技術——從山地地震到鑽井，從採氣到集輸加工的成套獨特工藝。經過幾十年的勘探建設，在這里業已形成中國最大的天然氣工業基地。

這本畫冊，它凝結着幾代找油者的艱苦歷程和他們的豐碩成果以及他們對四川盆地天然氣工業發展的美好願望。

這本畫冊，具有四川“麻辣”的風格，是一部發人深省的油氣勘探的史冊。我們願把這本畫冊，獻給每一位參與四川盆地油氣勘探建設的工作者和關心支持四川勘探的海內外的朋友們。願這本畫冊，也成為我們結識新朋友的一道彩虹、一道橋樑，讓更多的海內外朋友熟悉和了解四川盆地的油氣勘探的光輝歷史、現狀和美好的未來。

溶洞

石灰岩、白雲岩被水溶蝕後，形成各種洞穴和孔隙，是四川盆地石油天然氣的儲集空間

SOLUTION VUGS AND CAVITIES IN ANCIENT LIMESTONE AND DOLOMITE ARE THE RESERVOIR VOIDS OF OIL AND GAS IN SICHUAN BASIN



BEAUTIFULLY AND RICHLY ENDOWED BASIN, GLORIOUS AND MAGNIFICENT HISTORY

PREFACE

Sichuan Basin is one of the big basins in China with a long history of oil and gas exploration, abundant mineral deposits and beautiful landscape. It looks like a jewel of dazzling beauty inlaid into a picture of China in the southwestern part. We are attracted not by the Buddha's light of Emei Mountain, the magic lanterns of Qingcheng Mountain, the fairyland of Jiuzhaigou (Nine Villages Gullies), and the grandeur of Three Gorges, nor are we fascinated by the mellowness of Sichuan spirits, the spicy taste of Sichuan dishes, the humorous tune of Sichuan operas and the lingering rhyme of Sichuan melodies. Our gazing looks are focused on the massive and profound sedimentation of millions of years, yearning for and searching for the treasures of oil and gas hidden in this vast basin.

When we turn the pages of this album and follow the photographer's camera, we are reading the voluminous historical records of underground formation, recalling the past and looking at the present of Sichuan Basin, we are exploring the mystery of underground structures and the wondrous combination of fractures and cavities in an effort to develop the rich resources of oil and gas therein.

The flame of the gas well at Linqiong (now Qionglai) drilled by our ancestors two thousand years ago illuminated the horizon in the Orient. This was the first gas well in the world, which opened up the path for man's utilization of natural gas. This great achievement has been recorded in the annals of the world history of petroleum.

One hundred and fifty years ago, in Ziliujing gas field, Yanhaijing well set a record of the first deep well over one thousand meters in the world. Later Mozhiqing well, producing over one million cubic meters of natural gas per day was put into production successfully. The tall wooden derrick, which has turned dark yellow over the years, still stands aloft in the gas field. It reminds us of the wisdom and greatness of our ancestors and at the same time the heavy burden on our shoulders.

So many years have elapsed. So many things have changed.

The pioneer explorers of a new epoch, with the geological hammer in the hand, marched to the vast area of 180,000 sq.km. of Sichuan Basin, heralding in a new chapter of petroleum exploration. They have been

fighting, they have been exploring, they have been investigating over the decades of the thirties, the forties, the fifties, ... In revealing the secret of fractured carbonate gas reservoirs, the history of the exploration and development of oil and gas in Sichuan Basin is a record of the course of struggle and painstaking efforts of generations of petroleum geologists and engineers.

From the roaring of Shiyougou gas well in Baxian County, Chongqing to the exploration of gas in southern Sichuan, from the gushing of oil at Longnushi in central Sichuan to the discovery of Weiyuan gas field, from the gas strike in Permian and Triassic formations to the gas strike in Carboniferous, every course of work, or every finding means a step forward on the way to knowledge and every success in exploration is achieved through arduous efforts. The growth of natural gas industry in Sichuan as the result of the hard work in exploration has proved that the explorers are worthy of the trust placed on them.

Here in Sichuan is the deepest well (7078 m) and the first horizontal well in China. A complete set of technologies aimed at fractured gas reservoirs, including seismic prospecting and drilling in mountainous areas, gas production, gathering, transportation and purification have been developed. Over several decades of exploration and development, Sichuan has become the biggest base of natural gas in China.

This album symbolizes the difficult journey of several generations of the explorers of oil and gas, their great achievements, and their aspirations for a booming natural gas industry in Sichuan.

This album, with its pricking and spicy flavor of Sichuan cuisine, is an enlightening historical record of the exploration of oil and gas. We dedicate it to every participant of oil and gas exploration and development in Sichuan, and to every friend at home and abroad, who shows interest and support for our work. May this album serve as a rainbow or a bridge that enables us to make new friends, that enables our friends at home and abroad to have a better knowledge of the glorious past, the stimulating present and the promising future of the exploration of oil and gas in Sichuan Basin.



岩石裂縫

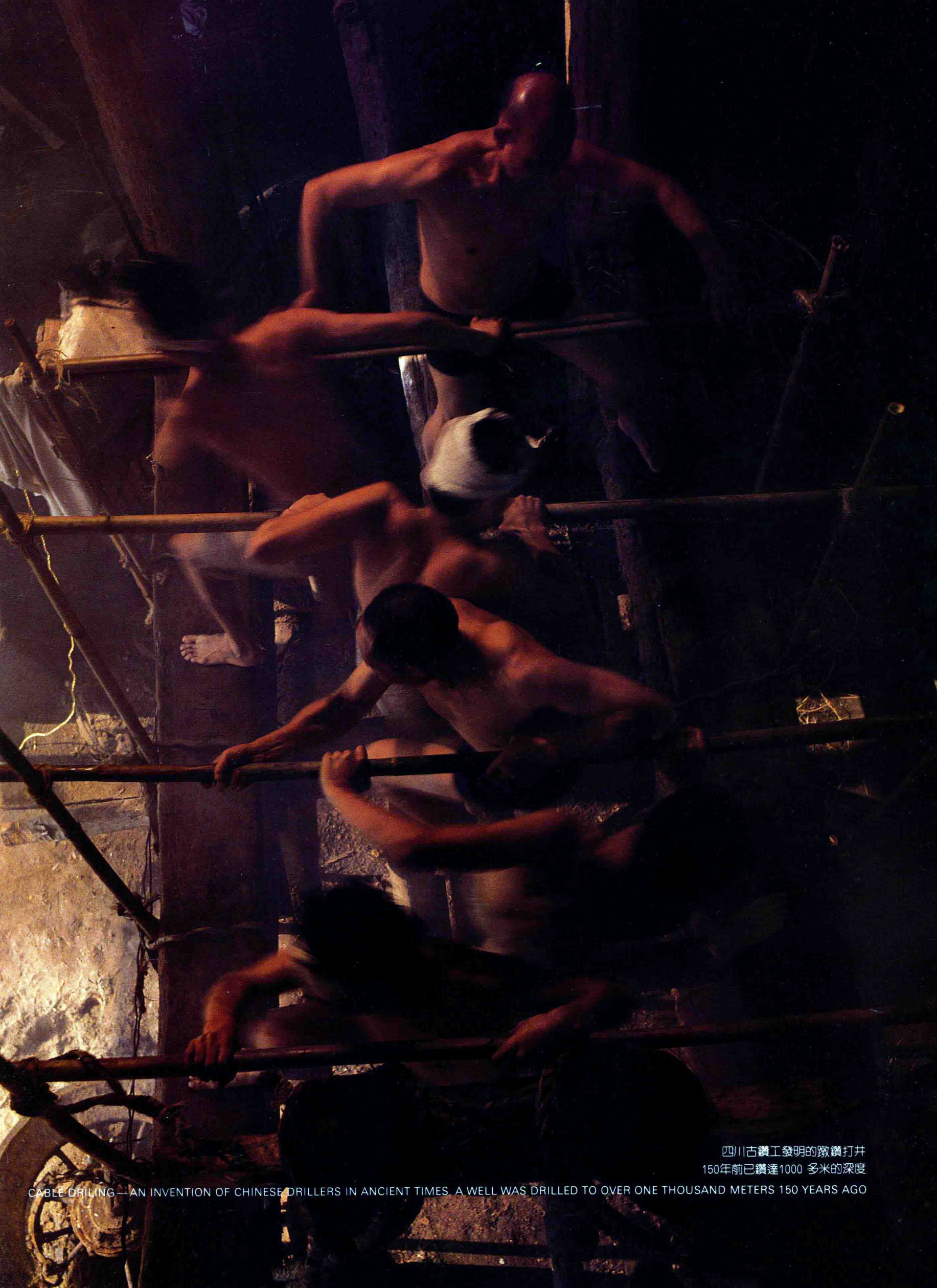
由地層褶皺產生的岩石裂縫，是四川盆地石油天然氣運移和產出的主要通道

VARIOUS TYPES OF ROCK FRACTURES PRODUCED BY FOLDING OF EARTH CRUST ARE THE MAIN PATHWAY OF HYDROCARBON MIGRATION AND ACCUMULATION.



臨邛古火井的輸氣管道
據記載，“臨邛有火井，丞相往復之”（丞相是指三國時代蜀國丞相諸葛亮）

THE REMAINS OF GAS PIPELINE OF AN ANCIENT GAS WELL AT LINQIONG. THE PRIME MINISTER OF KINGDOM SHU, ZHUGE LIANG WAS HERE ONCE ON INSPECTION



四川古鑽工發明的繳鑽打井
150年前已鑽達1000 多米的深度

CABLE DRILING — AN INVENTION OF CHINESE DRILLERS IN ANCIENT TIMES. A WELL WAS DRILLED TO OVER ONE THOUSAND METERS 150 YEARS AGO

