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中国震例

EARTHQUAKE CASES IN CHINA

（1997～1999）

主　编　陈棋福
副主编　郑大林　高荣胜

地震出版社

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内 容 提 要

《中国震例》系列丛书是研究地震和探索地震预测预报的重要科学资料，分别于1988、1990、1999、2000和2002年出版了《中国震例》1～7册，合计收录了1966～1996年间发生的178次地震共163个震例总结研究报告。本册（第8册）收录了1997～1999年间发生的37个M_S≥5.0级地震及1998年4月16日广西环江M_S4.9级地震的震例总结研究报告共26篇，每个报告大体包括摘要、前言、测震台网及地震基本参数、地震地质背景、烈度分布及震害、地震序列、震源机制解和地震主破裂面、观测台网及前兆异常、前兆异常特征分析、应急响应和抗震设防工作、总结与讨论等基本内容。本书是以地震前兆异常为主的系统的、规范化的震例研究成果，文字简明、图表清晰，便于查询、对比和分析研究。

本书可供地震预测预报、地球物理、地球化学、地质、工程地震等领域的科技人员，地震灾害管理专家学者，大专院校师生及关心地震灾害的读者使用和参考。

Synopsis

The multi-volume series book of "Earthquake Cases in China"contains important scientific data and information for seismological studies and researches on earthquake forecast and/or prediction. Volumes I to Ⅶ of this multi-volume series book were published in 1988, 1990, 1999, 2000 and 2002 with 163 case study reports on 178 earthquakes occurred from 1966 to 1996. This volume (Volume Ⅷ) includes 26 study reports on cases of 37 earthquakes of $M_S \geqslant 5.0$ occurred from 1997 to 1999 and 1 earthquake with M_S 4.9 occurred on April. 16, 1998 in Guangxi Zhuang Autonomous region. In general, each case report includes abstract, introduction, seismic network and basic parameters of an earthquake, seismogeological background, seismic intensity distribution and earthquake damages, earthquake sequence, focal mechanism solutions and main fault plane, monitoring network and precursory anomalies, analyses on characteristics of precursory anomalies, measures of emergency response and earthquake protection, summary and discussions. This book is a collection of basic analyses and results of systematic and standardized studies on earthquake cases based mainly on the earthquake precursory anomalies. Simple and concise illustrations and distinct figures and tables are convenient for readers to get references, to make comparisons and analyses.

The book can be used and referred to by scientific and technical workers of earthquake forecast and prediction, geophysics, geochemistry, geology, engineering seismology, by earthquake disaster managers, by university and/or college teachers and students and by readers who are interested in seismic hazard reduction.

编 写 说 明

中国地震前兆的观测和预测预报实践从1966年邢台地震开始，已走过30多年的历程，取得了显著的进展。地震预测预报是以观测为基础的科学，短临预测预报作为地震预测预报的主要目标，实现它的重要环节是获取可靠的地震前兆异常，通过综合分析进而进行地震发生时间、地点和震级三要素的预测预报。因此，全面地积累每次地震的地震地质、震害、地震参数、地震序列，尤其是地震前兆异常及预测预报和应急响应的经验教训等资料，对于地震科学研究、地震预测预报和防震减灾具有十分重要的科学价值。经过研究整理的一次或一组地震的上述资料，本书中称之为震例研究报告，它们是地震预测预报及其研究的基础。

1966年以来我国大陆发生了众多的5级以上地震，其中的许多地震已有不少研究论文和专著，但由于没有统一的规范和要求，不便对这些地震进行系统的综合分析对比。为了系统地研究地震前兆和推进地震预测预报工作，中国地震局于1986～1987年安排了我国大陆1966～1985年5级以上地震的研究项目，作为该研究的成果，《中国震例》系列丛书1～3册分别于1988年和1990年出版，含58个震例研究报告，系统地研究总结了60次地震。 1992年起中国地震局安排了1986～1991年第二批震例的研究，共完成56个震例研究报告，包括60个地震震例，1999年和2000年出版了《中国震例》第4和第5册。在科技部和中国地震局的支持下，针对1992～1999年发生的中国大陆灾害性地震震例总结研究，在2000～2002年间得以继续进行。继2002年8月和12月出版的第6、7册的1992～1996震例总结研究报告之后，本册（第8册）收录了1997～1999年发生的26个震例总结研究报告。

《中国震例》的震例研究和报告编写工作按统一的《震例研究和报告编写规范》进行，以研究报告集的形式按地震发生日期顺序编辑成册。本册与第6和第7册的基本要求和规定一致，各报告按以下基本章节内容进行编写：

一、摘要

概述报告的主要内容。

二、前言

概述主震或重要地震的基本参数、震害、预测预报、宏观考察和研究历史等基本情况。

三、测震台网和地震基本参数

给出地震前震中附近测震台网情况和主震或重要地震的基本参数。对同一地震，当不同单位给出不同参数时，则分别列出，编写人认为最合理的参数放在第一条。

四、地震地质背景

简要介绍震中附近地区的区域大地构造位置、深部构造条件、区域形变场概貌、历史地震活动及主要构造与断裂的活动性，以及与发震构造有关的资料。

五、烈度分布与震害

给出烈度分布图、宏观震中的地理位置。简要介绍等震线范围、重要地表破坏现象、烈度分布特征及震害评估结果。

六、地震序列

尽可能给出全序列资料（包括直接前震和余震的有关参数）、余震震中分布图、地震序列类型、应变释放曲线或能量衰减曲线图、序列 b 值、频度衰减系数及较大余震目录等。

七、震源机制解和地震主破裂面

分别给出震源机制解图和表。对同一地震，如有不同的解，则分别列出，编写人认为最合理的解列在表中第一条。综合分析地震主破裂面与发震构造的关系。

八、观测台网及前兆异常

介绍地震前的定点前兆观测台网及其他有关观测情况。规定 $M_S \geqslant 7.0$ 地震距震中 500 km，$6.0 \leqslant M_S < 7.0$ 地震距震中 300 km，$5.0 \leqslant M_S < 6.0$ 地震距震中 200 km，作为定点观测台网前兆观测资料的统计范围，给出此范围内测震台（项目）以外的其他地震前兆定点观测台站（点）或观测项目分布图，并在必要时给出前兆异常项目平面分布图。认为与此次地震孕育过程有关的全部前兆异常，包括非定点台网观测到的异常和上述规定距离以外的重要异常，均列入前兆异常登记表，并给出前兆异常图件。概述前兆异常的总体情况，以图表为主，必要时加以简要文字说明。对测震项目以外所有定点观测台站（点）的所有观测项目或异常项目进行累加统计时，其统计学单位称为台项。对前兆异常登记表中的异常项目进行累加统计时其统计单位称为项次或条。

为保证资料的可靠性，要求所用数据的观测质量必须符合观测规范，且能够区别正常动态与异常变化。根据地震前兆观测资料清理和分析研究的结果把观测资料质量划分为三类：1 类——符合上述要求；2 类——基本符合；3 类——不符合。规定只选用 1、2 类观测资料，3 类资料不予使用，亦不进入统计。异常判定应经过全部资料和全过程的分析，经排除干扰和年变等因素后，根据一定的判据，认定与地震关系密切的变化才列入异常登记表。

规定按时间发展进程把异常分为 L、A、B、C 四个阶段类别：L——长期趋势背景异常，出现在地震前 5 年以上；A——中期趋势背景异常，出现在震前 0.5～5 年；B——为短期趋势异常，震前 1～6 个月；C——临震异常，震前 1 个月内。另外，对规定的震中距范围以外，或据现有认识水平一时无法解释，或非常规观测的、值得研究的其他可靠和较可靠的异常现象划为 D 类，在相应的异常阶段类别前冠以 D 字样，以留下资料和记录供后续研究。对各类异常，按照其可信程度，又区别为 Ⅰ、Ⅱ、Ⅲ三个等级，以下角标标示：Ⅰ——可靠；Ⅱ——较可靠；Ⅲ——参考，留作记录。D 类异常只取 Ⅰ 和 Ⅱ 两类。如：$C_{Ⅱ}$ 为较可靠的临震异常；$DA_{Ⅰ}$ 为可靠的中期 D 类异常。关于 Ⅰ、Ⅱ、Ⅲ等级的确定，主要尊重总结研究报告作者的意见，编辑过程中仅作了个别调整，供读者参考。宏观异常在登记表中总的作为一项异常。异常登记表中各栏目，是报告作者对异常研究的结果，目的是为了给读者提供使用、研究和参考的方便。对异常进行认真审核和分类处理，既可达到去粗取精、去伪存真的目的，又可避免丢失可能有科学价值的异常记录，以利于进一步研究和资料积累。尽管如此，书中辑入的异常未必都恰当，读者可根据提供的资料和文献进一步做出判断。

全书对异常登记表中使用的观测手段和异常项目名称及图件中的常用图例作了统一规

定（见后续一览表和图例）。

九、前兆异常特征分析

简要给出对主要异常特征的综合分析与讨论，给出要点，提出有依据的看法和待研究的问题。

十、应急响应和抗震设防工作

简要介绍（记录）预测预报、应急响应和抗震设防等方面的重要情况和工作过程，包括对强余震的监测情况等。

十一、总结与讨论

从科学上讨论有技术和工作特色的经验、学术观点、教训和问题及启示。

十二、参考文献和资料

给出在震例研究和报告编写工作中引用的全部文献和资料目录，同时也尽可能列出与该地震相关的但作者并未引用的文献资料。报告中直接引用已出版文献或未出版的参考资料、图件和工作结果时均应注明来源，以便读者进行核对或追踪研究。

对于已发表有专著的强震，根据专著发表后的研究成果，亦按以上要求编写震例报告，并进行必要的资料补充，专著中发表过的异常图件一般从略，文字从简。

本书辑入的震例总结研究报告是前人和作者对该次震例资料整理和研究成果的集中表达，是以地震前兆异常为主的系统的、规范化的震例科研成果。《震例研究和报告编写规范》及《中国震例》编辑组工作的指导思想是：经过科学整理和分析研究，给出各次地震的基本资料，既可供读者使用、参考，又可供进一步追踪研究；既具有资料性，又要反映目前研究程度；文字力求简明，避免冗长的叙述和讨论，尽量使用图表，便于对比。由于资料和研究程度的差异，各报告在坚持质量和科学性的前题下，根据实际情况编写和编辑，因此篇幅和章节编排不尽一致。

中国大陆地震前兆的观测与预测预报实践表明，地震蕴育和发生是一个极其复杂的过程，影响因素很多，伴随这一过程有许多异常现象，我们把那些与地震蕴育、发生过程相关联的有别于正常变化的异常变化称之为地震前兆异常，即采用了广义地震前兆的概念。本书辑录的前兆异常，是经过审核的与地震蕴育、发生过程有关联的异常现象，其中既可能有区域构造应力场增强引起的异常（“构造前兆异常”），又可能有来自震源的信息（“震源前兆异常”），具有不同的前兆指示意义，无疑包含着丰富的可能的前兆信息。因而震例研究报告是地震前兆研究和预测预报探索的宝贵财富，它既是进一步研究的基础资料，又可供在今后震情判定中借鉴。需要指出的是，震例报告是震后经过若干年的资料收集、发掘、整理和总结研究之后编写的，从震后总结到实现震前的科学预测预报，还要经过一段艰难的路程。

此次的 1992～1999 年震例总结研究工作列入国家科技部社会公益性项目中的“中国灾害性地震震例综合研究”项目和中国地震局“中国大陆震例的研究”项目。工作中充分吸收了 1966～1991 年的震例总结研究和报告编写的经验和教训，为适应现代防震减灾工作发展的要求，对原有的《震例研究和报告编写规范》再次修订后，以中震测[2000]068 号文下发了《震例研究和报告编写规范》，并对参与此次震例总结研究单位的技术负责人或骨干进行了培训和工作研讨。本书所辑入的震例报告，按“属地原则”由发生地震的省、直辖市、自治区地震局负责总结研究。各报告对前人或相关的研究工作成果，特别是地震前兆研究的成果，虽尽力作了反映，但由于人员变动和资料收集的困难，以及水平限制等

原因，难免仍会有疏漏，对个别异常和资料的处理亦可能会有不妥之处。

1992～1999年震例的总结研究和报告的编写及本书的编辑、出版，得到了各省、直辖市、自治区地震局（办）和地震出版社有关领导和专家的大力支持和帮助，尤其是得到中国地震科技发展司有关领导的鼎力支持，在此一并致谢。

本批震例的研究和报告的编写工作由中国地震局监测预报司具体组织，共有16个省、市、自治区地震局参加，中国地震局分析预报中心为项目负责单位。各单位的项目负责人是：分析预报中心陈棋福、郑大林、粟生平；北京市地震局徐平；河北省地震局黄保大；山西省地震局啜永清；内蒙古自治区地震局曹景泉、薛丁；辽宁省地震局王安东；上海市地震局林命周、章纯；江苏省地震局谢华章、田建明；福建省地震局丁学仁、林树；山东省地震局刁守中、苏鸾声；广西壮族自治区地震局吴时平；四川省地震局杜方；重庆市地震局李克昌；云南省地震局万登堡、马殿军；甘肃省地震局杨立明、肖丽珠；青海省地震局马文静、陈玉华；新疆维吾尔自治区地震局王海涛、高国英，直接参加报告编写的人员达90人左右。

本册的编辑工作由《中国震例》编辑组完成。名誉主编——张肇诚；主编——陈棋福；副主编——郑大林、高荣胜；编辑组成员——陈棋福、郑大林、高荣胜、张肇诚、粟生平、汪志亮、孙士宏、薛艳；申旭辉对全书的地震地质背景部分进行了统一的审定；顾国华对全书的英文进行了统一审译；张肇诚、张炜对英文图、表名进行了译校工作；粟生平在作者提交的电子文稿上进行了最终定稿修改；书中图件由地震出版社郭京平、孙铁磊、宋玉和徐雁生进行了加工和清绘。《中国震例》（1992～1999）编辑组在此次工作中，制订了较严格的2或3人分别把关评审与主编或名誉主编审定的工作程序，为保证质量还采取了对震例总结研究报告进行评比奖励的措施，确保每份报告至少都经历了初稿、修改稿（1次或多次）与承担单位的验收等过程。编辑组在严格遵守“作者文责自负”的前提下，在不违背原则的情况下对每份报告的体例、资料和分析结果等进行了适当的编辑处理，如在地震基本参数表中增加了中国地震局地球物理研究所（以BJI表示）给出的参与国际交换的参数，国际地震中心（ISC）确定的参数。编辑组虽然作了很大努力，但由于水平和条件所限，书中可能还有不周或不足之处，望予谅解并提出宝贵意见。

编　者

2002年10月，北京

About This Book

In China, practices in earthquake precursor observations and earthquake forecast or prediction have been carried out for more than 30 years since the Xingtai earthquake in 1966 and substantial progress has been achieved. Earthquake forecast and prediction is a science that based mainly on observations. The short term and imminent forecast or prediction of the time, magnitude and place of an earthquake is the principal goal of earthquake forecast or prediction. Successful forecast or prediction can only be achieved on the basis of acquisition of reliable data of earthquake precursory anomalies and comprehensive analyses of all data. Therefore, for earthquake research, prediction, protection and hazard mitigation it is of particularly important scientific value to accumulate extensive data of seismogeology, earthquake disasters, earthquake parameters, earthquake sequence, especially earthquake precursor anomalies and lessons of prediction and emergency response of an earthquake. The above-mentioned systematic data of an earthquake or cluster earthquakes obtained through researches and classification are treated as earthquake case study reports in this book. They are the foundation data for earthquake forecast or prediction and related researches.

Many earthquakes of $M_S \geqslant 5.0$ occurred in China mainland since 1966. Numerous papers and/or works related to many of them have been published and/or carried out. But due to lack of unified standards and requirements, those results could not be analyzed and compared systematically and comprehensively. In order to carry out comprehensive studies on earthquake precursor anomalies and to promote earthquake forecast and prediction research, during 1986－1987 the China Seismological Bureau launched a project for researches on earthquakes with $M_S \geqslant 5.0$ occurred in China mainland during 1966－1985. As a result, the first three volumes of Earthquake Cases in China were published in 1988 and 1990, containing 58 earthquake case reports of systematic studies on 60 earthquakes. Since 1992 the China Seismological Bureau had initiated the researches of the second phase on earthquake cases. Many researches were carried out and 56 research reports on 60 earthquake cases were summarized and published in Volume Ⅳ and Ⅴ in 1999 and 2000 respectively. With support from the Ministry of Science and Technology and the China Seismological Bureau, researches on cases of earthquakes occurred during 1992－1999 in China mainland were continued from 2000 to 2002. As Volume Ⅵ and Ⅶ puklished in Auguest and December 2002 with reports of earthquake cases from 1992 to 1996, this volume (Volume Ⅷ) includes 26 research reports on 37 earthquakes occurred from 1997 to 1999.

The book is compiled in the form of collection of reports on earthquake cases arranged according to occurrence dates of the earthquakes. All reports of earthquake cases were written with the reference standards and requirements of "Specifications for Earthquake Case Study and Compiling of Case Study Reports". This volume inherited the basic format of the previous

volumes Ⅵ and Ⅶ. Each report contains the following basic components:

Abstract is a summary of the major contents.

Introduction gives a brief description of the occurrence time of the main shock or earthquakes, its or their damages, the status of prediction or forecast, the macroscopic investigations and the history of earthquake studies, etc.

Seismometric Network and Basic Parameters of the Earthquake gives the distribution of seismometric network near the epicenter before the event(s) and the basic parameters of the main shock or earthquakes. When the different parameters of an earthquake were given by different agencies, they are listed separately, but the first one on the list is the parameters that the authors deem most reasonable.

Seismogeological Background gives a brief description of the regional geotectonic structures, deep structures, general picture of the regional deformation field, historical earthquake activity, activities of main structures and faults and other data associated with the seismogenic structures around the hypocenter.

Distribution of Seismic Intensity and Damages illustrates the distribution of seismic intensity, the geographic location of the macroseimic epicenter. The range of isoseismal lines and significant phenomena of surface destruction are described, the features of intensity distribution and the estimated earthquake damages are outlined.

Earthquake Sequence provides the whole sequence (including the relevant parameters of all direct foreshocks and aftershocks), the distribution of aftershock epicenters, the type of the sequence, the strain release curve or the energy attenuation curve, b -value of the sequence, the frequency attenuation coefficient, and the catalogue of major aftershocks.

Focal Mechanism Solution and Main Rupture Plane gives figures and tables of the focal mechanism solutions. When there are different solutions, they are given separately, with the most appropriate one is listed as the first one by the authors. Comprehensive analyses are made on the relation between the earthquake rupture plane and the seismogenic structure.

Monitoring Network and Precursory Anomalies describes the precursor monitoring network and other related observations. Statistical analyses are made on the precursory anomalies obtained from the networks within the distance of 500 kilometers from the epicenters of the $M_S \geqslant 7.0$ earthquakes, within 300 kilometers from the epicenters of earthquakes of $6.0 \leqslant M_S < 7.0$, and within 200 kilometers from the epicenters of the earthquakes of $5.0 \leqslant M_S < 6.0$. Maps of fixed observation stations (points) or observation items (except seismic observation items) within such distances and maps of distribution of precursory anomalies (only indicating precursory items of fixed observations except seismicity anomalies) are also provided. All anomalies that are assumed to be closely linked with the process of the earthquake preparation, including the important anomalies at non-fixed observation points and outside the defined distances, are listed in the table of precursory anomalies with corresponding figures. The overall situation of the precursory anomalies is outlined, mainly with figures and tables and with concise illustrations if necessary. The statistic unit of observation items or anomaly items of all stations (points) is called station-item.

In order to ensure the reliability of the data, the observation quality of the data must meet the observation specifications and the normal variations and anomalous changes can be distinguished. According to the result of the sorting out and analyses of the precursor observations, the quality of the observation data are classified into three classes: Type 1—the data meet the above mentioned quality requirements; Type 2—the data meet the quality standards in general and the normal variations and anomalies can be distinguished; Type 3—the data don't meet the requirements. It is decided that only the first two types of data can be used, while the data of the third type will not be selected for statistical analyses. The anomalies are identified on the basis of result of analyses on all data during the whole process after eliminating contaminations, annual variations, and other contamination factors. Thereafter, only anomalies identified to be closely associated with earthquakes are listed in the summary table of precursory anomalies.

The anomalies are divided into four classes L, A, B, and C according to the time development of the anomalies. Class L indicates the long-term trend anomalies that appear five years or more before the earthquake. Class A is the mid-term trend anomalies which occur about six months to five years before the earthquake. Class B denotes the short-term anomalies which last for about one to six months before the earthquake. Class C means the imminent anomalies that occur within approximately one month before the impending earthquake. In addition, class D is introduced to include certain reliable or fairly reliable anomalies that deserve further studies. They might appear at observation stations that are even further away from the epicenter than the defined distance, they could not be explained with present knowledge, or they are not obtained by conventional observations. The anomalies are further classified according to their reliability into degree I, II and III, with I—reliable; II—fairly reliable; and III —for reference. But the anomalies of class D are only given with degree I and II. The reliability degree is marked by subscript to the class symbols. For example, C_{II} is a fairly reliable imminent anomaly; DA_{I} is a reliable mid-term anomaly of calss D. They are usually determined by the opinions of the authors, except a few are revised by the editors for reader's reference. The macroscopic anomalies registered in the summary table of precursory anomalies are regarded as one item of anomalies. Various items of anomalies registered in the table are the research results obtained by many authors and are provided to the readers to utilize, study and refer to with convenience. The stringent evaluation and classification of the anomalies not only serves the purpose of selecting the high quality data, but also helps to avoid the possibility of missing any scientifically valuable records of anomalies that are useful in further scientific analyses. However, the anomalies included in the book are not necessarily correct for all of them and readers should make further judgment based on the data and references provided.

The names of the observation items (anomaly items) and legend in the figures are unified in the following pages.

Analyses of Features of Precursory Anomalies gives comprehensive analyses and discussions on features of the main anomalies with interpretation based on facts and opinions on problems for future study.

Measures of Emergency Response and Earthquake Prevention gives brief introduction on important situations and procedures of the work in earthquake forecast or prediction, emergency response and earthquake prevention, including the monitoring of strong aftershocks and so on.

Discussions and Concluding Remarks explores scientifically the experience, academic ideas, lessons, problems and revelations that are characteristic in technology and practical work.

References and Information lists all references and data catalogues which have been referred during the case study and report compilation. References that are related with the earthquake but not quoted by the author(s) are listed as many as possible. The origins of published and unpublished data, figures and results, which are directly quoted in the reports, were given also.

Some strong earthquakes that have been studied in published monographs are also compiled with earthquake case reports, with necessary data supplemented. However, the published figures of anomalies are usually ignored and illustrations are simplified.

Each of the earthquake case reports contained in this book is the manifestation of the achievement gained by the predecessors and authors in sorting out and studying the earthquake case. They are the fruit of a systematic and standardized scientific research on earthquake cases with emphasis on precursor anomalies. The Editorial Board of Earthquake Cases in China has been worked under the guide line that this book will provide readers for their use, reference and future research with basic data of each earthquake obtained through scientific sorting out and analyses. Therefore, all reports are designed to have abundant information and clearly indicate the current research level. The literal illustrations are as simple as possible without lengthy descriptions and discussions, so available figures and tables are given for comparison. Each report is compiled and written to the highest possible quality and scientific soundness. However, owing to differences in data and research extent and the actual situations, the length and style for all reports are not exactly the same.

The earthquake precursory observations and forecast or prediction practices in China mainland have shown that the preparation and occurrence of an earthquake is a rather complicated process influenced by many factors and accompanied by various anomalous phenomena. We call the anomalies that are closely linked with the process of the preparation and occurrence of an earthquake and distinct from the normal background of variations as precursor anomalies, or as precursors in general sense. The precursory anomalies included in the book are examined to be relevant phenomena associated with the process of earthquake preparation and occurrence. Among them there may be anomalies caused by intensification of regional tectonic stress field (referred to as "tectonic precursor anomalies") and the information from a single seismic focus (called as "focal precursor anomalies"). They have different precursory implications, undoubtedly with possible and rich precursory information. Therefore the earthquake case reports are the valuable accumulations for studies on earthquake precursors and forecast or prediction. They provide not only basic data for further investigations, but also contribute references for future assessment of the development of earthquake activity. However,

it should also be noted that those earthquake case reports have been compiled through several years of collection, analysis and exploration, and summarizing of the data after the earthquakes, and there is still a long and arduous way from the post-earthquake summarization to scientific earthquake forecast or prediction.

The studies on the earthquake cases of 1992—1999 were supported by the project of "Case studies on disaster earthquakes in China" for public affairs by the Ministry of Science and Technology and the project of "Earthquake cases study of China mainland" of the China Seismological Bureau. The joint project was based fully on the experience and lessons from the previous studies on the earthquake cases of 1966 to 1991 and from compiling the reports. In order to meet the requirement for the modern development of earthquake prevention and disaster mitigation, the original text of "Specifications for Earthquake Case Study and Compiling of Case Study Reports" was revised once again. Then "Specifications for Earthquake Case Study and Compiling of Case Study Reports" was published as Document No. [2000] 068 of the China Seismological Bureau. A training workshop was hosted in Beijing in 2000 for persons from different participant institutions of the project who were in charge of cases study of some earthquakes for the joint project. The earthquake case reports collected in this book were prepared by seismological bureaus of the provinces, metropolitan cities and autonomous regions according to the principle of the earthquake location. Though all efforts were made to ensure that the reports reflect the achievement of researches obtained by the predecessors or in related researches and particularly the achievement of researches on precursors to earthquakes. However, due to personnel changes and limited data accessibility, there might be inappropriate omissions or improper processing of individual anomalies and data.

Relevant leaders and many friendly individuals from the China Seismological Bureau, the Center for Analysis and Prediction, CSB, Seismological Bureaus (Offices) of some provinces, metropolitan cities and autonomous regions concerned and the Seismological Press, have rendered great support and assistance in compiling the earthquake case reports, as well as in editing and publishing this book. The authors and editors are grateful to all of them for their great support and help which has made this book possible, especially for the powerful support form the Department of Science and Technology Development of CSB.

The Department of Monitoring and Prediction of CSB organized the studies on earthquake cases for the project Sixteen institutions from seismological bureaus of provinces, metropolitan cities and autonomous regions took part in this project with the Center for Analysis and Prediction, CSB, as the project organizer. The persons in charge of the project from these institutions are listed as follows: Chen Qi-fu, Zheng Dalin and Su Shengping from the Center for Analysis and Prediction, CSB; Xu Ping from the Seismological Bureau of Beijing; Huang Baoda from the Seismological Bureau of Hebei Province; Chuo Yongqing from the Seismological Bureau of Shanxi Province; Chao Jingquan and Xue Ding from the Seismological Bureau of Inner Mongolian Autonomous Region; Wang Andong from the Seismological Bureau of Liaoning Province; Lin Mingzhou and Zhang Chun from the Seismological Bureau of Shanghai; Xie Huazhang and Tian Jianming from the Seismological Bureau of Jiangsu Province; Ding

Xueren and Lin Shu from the Seismological Bureau of Fujian Province; Diao Shouzhong and Su Luansheng from the Seismological Bureau of Shandong Province; Wu Shiping from the Seismological Bureau of Guangxi Zhuang Autonomous Region; Du Fang from the Seismological Bureau of Sichuan Province; Li Kechang from the Seismological Bureau of Chongqing; Wan Dengbao and Ma Dianjun from the Seismological Bureau of Yunnan Province; Yang Liming and Xiao Lizhu from the Seismological Bureau of Gansu Province; Ma Wenjing and Chen Yuhua from the Seismological Bureau of Qinghai Province; and Wang Haitao and Gao Guoying from the Seismological Bureau of Xinjiang Uygur Autonomous Region. There were about 90 scientists altogether who directly participated in compiling the reports.

The editorial work was completed by the Editorial Board of "Earthquake Cases in China". Zhang Zhaocheng is the honorary chief editor; Chen Qi-fu is the chief editor; Zheng Dalin and Gao Rongsheng are the associate chief editors; Chen Qi-fu, Zheng Dalin, Gao Rongsheng, Zhang Zhaocheng, Su Shengping, Wang Zhiliang, Sun Shihong and Xue Yan are members of the editorial board. Shen Xunhui has reviewed all sections of Seismogeological Background in the book. Gu Guohua has revised all the English translations in the book. Zhang Zhaocheng and Zhang Wei have done the English translations of the caption of figures and tables and revised them. Su Shengping edited and finalized the report texts based on the electronic manuscripts submitted by the authors. All figures in the book were drawn or modified by Guo Jingping, Sun Tielei, Song Yu and Xu Yansheng from the Seismological Press. The editorial board of "Earthquake Cases in China" (from 1992 to 1999) stipulated strict working procedures. Two or Three persons were in charge of appraising the reports and the chief editor or the honorary chief editor were in charge of final approving of the reports. In order to ensure the quality, an award announcement of the reports of earthquake case study according to appraisals was issued. For every report there had to be a manuscript, a revised manuscript (revised once or several times) and the manuscript had to be examined and accepted by the institution that participated the project. Under the prerequisite that "the author is responsible for his own report or paper", the editorial board made some appropriate editing of the format, data and the results of analyses without violation of the principles. For example, in the tables of the basic earthquake parameters the parameters from the Institute of Geophysics, CSB, for international exchange (marked with BJI) and parameters determined by the International Seismic Centre (ISC) are added. Though great efforts were made by the editorial board, there might still be some improper aspects in the book due to our limited scientific knowledge and work conditions. Therefore, any comments and corrections are greatly appreciated.

The Editorial Board
October 2002, Beijing

观测手段和异常项目名称一览表

观测手段	异常项目名称
测震	地震条带、地震空区（段）、空区参数σ_H、地震活动分布（时间、空间、平静或增强）、前兆震（群）、震群活动、有震面积数（A值）、地震活动性指标（综合指标A值，地震活动熵Q^t、Q^N、Q^Σ，地震活动度γ、S、模糊地震活动度Sy）、地震强度因子Mf值、震级容量维（D^0值）、地震节律、应变释放（能量释放）、地震频度、b值、h值、地震窗、缺震、E、N、S三项指标、诱发前震、前震活动、震情指数（$A(b)$）值、地震集中度（集中度C、空间集中度C_1、带状集中度C_B）、η值、D值；地震时间间隔、小震综合断层面解、P波初动符号矛盾比、地震应力降τ，环境应力值τ_0、介质因子（Q值）、波速（波速、波速比）、S波偏振、地震尾波（持续时间比τ_H/τ_V、衰减系数a、衰减速率p）、振幅比、地脉动、地震波形；断层面总面积（$\Sigma(t)$）、小震调制比、地震缺信量（Iq）、地震非均匀度GL值、算法复杂性（$C(n)$、Ac）
地形变	水准测量（长水准）、定点水准（短水准）、流动水准、海平面；定点基线（短基线）、流动基线；测距；地倾斜；断层蠕变
重力	定点重力，流动重力
地电	视（地）电阻率；自然电位
地磁	Z变化、幅差、日变低点位移、日变畸变；总场（总强度）、流动地磁；偏角；感应磁效应（地磁转换函数）
地下水	水氡、气氡、土氡（α粒子径迹密度），总硬度，水电导，气体总量，pH值，CO_2、H_2、He、N_2、O_2、Ar、H_2S、Hg、CH_4、SiO_2、Ca^{2+}、Mg^{2+}、K^+、Li^+、SO_4^{2-}、HCO_3^-、Cl^-、F^-含量；地下水位，地下水位与湖水位；水（泉）流量、水温
应力-应变	电感应力、钢弦应力；振弦应变、体积应变、压容应变
气象	气温；气压；干旱；旱涝；大气电位
其他微观动态	石油井动态；地温；电磁波；长波辐射（OLR）
宏观动态	宏观现象
综合	前兆信息熵（H）；异常项数