松散承压含水层下采煤压架突水机理与防治

许家林　王晓振　朱卫兵　著

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松散承压含水层下采煤压架突水机理与防治

MECHANISM AND PREVENTION OF SUPPORT CRUSHING AND WATER INRUSH DURING MINING UNDER UNCONSOLIDATED CONFINED AQUIFER

许家林　王晓振　朱卫兵　著

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内 容 提 要

本书全面介绍了松散承压含水层下采煤压架突水机理与防治的最新研究成果，内容包括：松散承压含水层下采煤覆岩破坏规律与压架突水机理、松散承压含水层下采煤压架突水灾害的影响因素和发生条件、松散承压含水层下采煤压架突水危险区域预测和压架突水灾害预警方法、松散承压含水层下采煤压架突水灾害防治技术及在祁东煤矿的应用与实践。

本书可供从事采矿、安全、地质等领域的科技工作者、高等院校师生和煤矿生产管理者参考。

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前　言

我国华东、华北等矿区许多煤矿厚表土层底部存在着一层以非胶结砂、砾为骨架组成的松散承压含水层，它直接赋存在煤系基岩顶部，对煤矿安全开采造成严重威胁。如何安全、高效地开采松散承压含水层下煤炭资源，是许多煤矿面临的重大技术问题。

近年来，我国一些矿区在松散承压含水层下采煤时，发生了严重的压架突水事故，造成重大经济损失，严重威胁煤矿安全生产。例如，皖北矿区祁东煤矿自2002年投产以来，曾先后在3_222、7_114、6_130、7_121等8个综采工作面发生17次压架突水事故，其中矿井投产后的首采面3_222工作面发生压架突水事故并导致矿井被淹，直接经济损失3 600多万元，被淹矿井恢复生产费用近1亿元，造成严重经济损失和生产被动局面。淮南、济宁、焦作等矿区在邻近松散承压含水层采煤时也曾发生类似祁东煤矿的压架突水灾害。引发此类突水事故的原因通常归结为存在断层、原生裂隙发育或松散承压含水层底界面降低等特殊地质因素，沟通了采动顶板导水裂隙与基岩顶部松散承压含水层。事实上，此类顶板突水灾害与工作面压架灾害都是伴生的，即工作面突水前都会出现矿山压力显现异常增大甚至压架现象，并随工作面推进周期性地发生，说明此类压架突水灾害与采动顶板破断运动特征紧密相关，反映了邻近松散承压含水层采煤覆岩破坏规律的特殊性，而传统理论难以合理解释此类压架突水灾害的发生机理。

作者对松散承压含水层下采煤压架突水灾害问题的研究始于2004年祁东煤矿7_114工作面压架突水事故防治的科研工作，经过系统、深入的研究发现：由于松散承压含水层的流动性和侧向补给作用，煤层开挖过程中作用于基岩顶界面的上覆载荷不像通常条件下随煤层开挖显著降低，而是基本保持恒定，即松散承压含水层起到载荷传递的作用。邻近松散承压含水层开采时，由于松散承压含水层的载荷传递作用，导致一定覆岩条件下松散承压含水层下部基岩整体破断和结构失稳，使得顶板导水裂隙带高度发育至松散承压含水层下，这是引发部分矿井在邻近松散承压含水层采煤时发生异常压架突水灾害的根本原因。基于松散承压含水层下采煤压架突水机理，揭示了松散承压含水层下采煤压架突水灾害的影响因素和发生条件，提出了邻近松散承压含

水层采煤压架突水危险区域预测方法和防治对策。有关研究成果在祁东煤矿得到验证和应用。本书即是上述研究工作的系统总结，希望本书的出版能为我国煤矿松散承压含水层下采煤压架突水灾害的防治提供参考和借鉴。

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受作者水平所限，书中难免存在不足之处，恳请同行专家和读者指正。联系电子邮箱:cumtxjl@cumt.edu.cn 或 wxzcumt406@163.com。

作　者

2012 年 12 月

Preface

In some east and north part of China, a layer of unconsolidated confined aquifer with high water pressure exits right above the rock bed on top of coal seam. It is composed of unconsolidated sand and grit and has a serious threat to coal mine safety. How to exploit coal resources under this unconsolidated confined aquifer safely and efficiently is a major technical issue faced by many coal mines.

In recent years, serious support crushing and water inrush accidents occurred in some coal mines during mining under such geological conditions, which resulted in significant economic losses and threaten to coal-mine safe production. For example, Qidong coal mine in Wanbei mining area occurred 17 times support crushing and water inrush disasters successively in eight working faces, such as no. $3_2 22$, no. $7_1 14$, no. $6_1 30$, no. $7_1 21$ working face, since 2002, the year it started production. No. $3_2 22$ working face was the first working face of Qidong coal mine. The disaster happened at this working face led to a mine flood, which caused serious economic losses and negative effect on production with a direct economic loss of more than 36 million Chinese Yuan and the recovering cost was almost one hundred million Chinese Yuan. Similar disasters occurred in Huainan, Jiaozuo and Jining mining areas when mining near unconsolidated confined aquifer. Reason of such accidents is usually due to which the roof water flow fracture and unconsolidated confined aquifer is connected caused by special geological factors such as fault, development of existing fractures or reduction of aquifer bottom interface. Actually, such water inrush disasters are always associated with support crushing problems. Severe pressure behavior and even support crushing usually happens periodically before water inrush happens during mining. This phenomenon indicates that such support crushing and water inrush disasters are closely related to the characteristics of the overlaying rock bed breaking and movement

after mining. The mechanism of this special problem cannot be reasonably explained by traditional theories.

The research of support crushing and water inrush disasters during mining under unconsolidated confined aquier began in 2004 at no $7_{1}14$ working face in Qidong coal mine. After systematical and deep research, the authors found that due to the mobility and recharge of confined water while mining, the load that acts on top of the overlying rock does not decrease as usual but remains constant. The unconsolidated confined aquifer could transfer the overlying load down to the working face. Due to this reason, the adjacent strata are prone to break as a whole and be structure unstable. Then the height of water flowing fractured zone will develop to the unconsolidated aquifers. This is the primary mechanism of the support crushing and water inrush accidents in such cases. Based on this mechanism, this book proposes occurrence conditions and influening factors, as well as the prediction methods and control measures of support crushing and water inrush accidents during mining under unconsolidated confined aquifer, which has been applied and validated in Qidong coal mine. This book is the systematic summary of the above research. We hope the publication of this book can provide a reference for preventing support crushing and water inrush accidents during mining under unconsolidated confined aquifer in China.

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support and help during measurement and application works in Qidong coal mine. Lastly, we want to express our most sincere gratitude to the authors of literatures referenced of this book.

Because of limited knowledge of authors, inadequacies in this book are inevitable, and any corrections or comments from experts and readers are welcome. E-mail:cumtxjl@cumt.edu.cn or wxzcumt406@163.com.

Authors
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