岩石力学与工程学报 2005 (17): 3094 ISSN: 1000-6915 CN: 42-1397/O3

南水北调西线一期工程阿坝段深埋长隧洞CSAMT地球物理勘探分类分析

柴建峰1，伍法权1，茅均标2，刘 彤1，陶 波1，晏长根1

(1. 中国科学院 地质与地球物理研究所，北京 100029；2. 中国地质大学 工程技术学院，北京 100083)

收稿日期 2005-2-24 修回日期 2005-3-17 网络版发布日期 2007-2-14 接受日期 2005-2-24

摘要 南水北调西线一期工程位于青藏高原东部边缘地带，地质条件复杂、断层密集分布、褶皱强烈发育。通过CSAMT物探进行前期工程地质勘察。依据区域地质条件、岩石电性特征和岩层的沉积环境，按电阻率的高低范围及变化特征将40 km长的CSAMT电阻率断面图分为4种类型，分别占测线总长的54.75%，38.75%，3.75%，2.75%，各种类型反映不同的地质情况，依次为：(1) 大范围的高阻区，CSAMT电阻率断面图结构变化疏缓，r为2 000～10 000 W·m；(2) 电阻率从地表向地层深处呈减小趋势，r 为1 000～50 W·m；(3) 电阻率从地表向地层深处呈变大趋势，r为50～10 000 W·m；(4) 条带状低阻区，r＜300 W·m。结合现场地质考察，地质解译为：类型1，3的高阻区为砂板岩互层地层，地下水不富集，岩体结构完整，工程地质条件简单；类型2反映了该区深部岩体富水性和透水性比浅表地层好，大范围的低阻与构造作用无明显联系，由岩性和地下水条件决定的，虽呈低阻，仍为工程施工优良工段。对工程稳定性有危害的为类型4反映的由断层及其影响带所引起的条带状低阻区。

关键词 岩土力学；可控源音频大地电磁法；电阻率；断层；地下水；深埋长隧洞

分类号

CLASSIFIED ANALYSIS OF CSAMT SECTION IN EMBEDDED TUNNEL EXPLORATION AT ABA SECTION OF FIRST STAGE OF WEST LINE PROJECT OF SOUTH-TO-NORTH WATER TRANSFER

CHAI Jian-feng1，WU Fa-quan1，MAO Jun-biao2，LIU Tong1，TAO Bo1，YAN Chang-gen1

(1. Institute of Geology and Geophysics，Chinese Academy of Sciences，Beijing 100029，China；
2. School of Engineering and Technology，China University of Geosciences，Beijing 100038，China)

Abstract

The first stage of the west route project of the South-to-North Water Transfer，which diverts water from the upper Yangtze River into the upper Yellow River，is located in the east edge of Qinghai—Tibet Plateau where the regional geological conditions are very complex. Active faults are distributed over the project zone，and strata are strongly folded. Through CSAMT exploration，the distribution of faults and groundwater are qualitatively analyzed；and the stability of embedded is evaluated. According to regional geology background，sedimentary rock modes and condition and physical features of rocks，the characters of CSAMT section to explore the strata structure，fault and groundwater condition are analyzed. The CSAMT section is classified into 4 types，accounting for 54.75 percent，38.75 percent，3.75 percent，2.75 percent respectively in the 40 kilometer long surveying line.

Each mode reflects different geological condition. For type 1 with wide high resistance area，CSAMT section changes sparsely and gradually，r ： 2 000–10 000 W· m. Type 2，wide low resistance area，CSAMT section also changes sparsely and gradually，but the resistance reduces from the ground surface to deep zone，r ： 1 000–50 W·m. For type 3 with wide high resistance area，the resistance increases from the ground surface to deep zone，r ： 50–1 000 W·m. For type 4 with low resistance strip，r＜300 W·m. The geological interpretation is that the wide high resistance area(type 1 and type 3) reflects that the groundwater is not abundant in the sandrock and slate stratum. The large region of low resistance anomaly(type 2) reflects the hydraulic permeability and water reservoir of deep rocks are better than the superficial rocks. Low resistance anomaly depends on ground water conditions and lithologic characters，not on tectonic movement. Sandrock filled with water may appear low resistance anomaly. According to groundwater condition，when the tunnel is excavated，these low resistance anomaly made of moderate to thick-bedded sandrock may cause water gushing but the amount of water which may affect the safety of tunnel is not much. The low resistance strip (type 4) which reflects fault and its crushed belt will affect the excavation of tunnel.

Key words rock and soil mechanics；CSAMT；resistance；fault；groundwater；long embedded tunnel

DOI:

通讯作者