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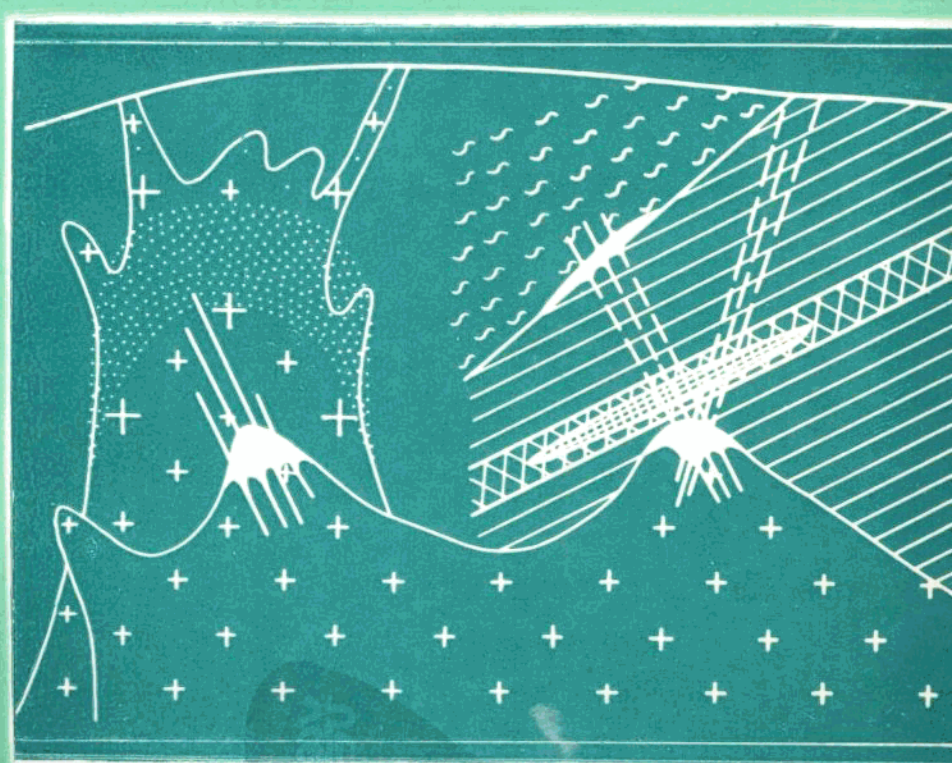
粤西南锡矿床成矿规律

俞受鏊　陈志中等 著



中山大学出版社

THE METALLOGENY OF TIN DEPOSITS
IN THE SOUTH-WEST OF GUANGDONG PRAVINCE

粤西南锡矿床成矿规律

俞受鋆 陈志中等 著

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内 容 简 介

本书是粤西地区锡矿成矿规律的研究专著。全书共分五章，它首次比较系统的阐述了粤西云开隆起中段（信宜—罗定一带）锡矿床区域地质背景，成矿地质特征及控矿地质条件，探讨了矿床成因，建立了成矿模式，应用成矿理论及测试成果，多学科、多方法开展隐伏锡矿床预测。书中在粤西地区的变质地层划分与对比、燕山期花岗岩类的阶段划分及各阶段岩体的地质地球化学特征和演化规律、北西向隐伏断裂带的特征及其对控岩控矿的主导作用、各类锡矿床控矿地质条件和化探找矿标志及化探模式图等方面都提供了新的资料和新的见解。

本书可供从事地质普查、矿山和科研的地质工作者及大、中专院校地质专业师生参考。

粤西南锡矿床成矿规律

俞受鋆 陈志中等 著

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中山大学出版社出版发行

轻工业部广州轻工业学校印刷厂印刷

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787×1092 毫米 16 开本 7.625 印张 4 插页 18.4 万字

1990 年 12 月第 1 版 1990 年 12 月第 1 次印刷

印数 1—650 册

ISBN7－306－00375－5

P·2 定价：4.50元

序

粤西南云开隆起区是我国重要的锡多金属找矿远景区之一。作者在系统地收集、整理和综合分析了区域地质调查、普查、勘探及有关研究资料的基础上，进行了详细野外调查、室内研究，及各种分析、测试等研究工作，通过三年多的努力，在掌握大量资料的基础上，著作了《粤西南锡矿床成矿规律》一书，它是这一重要锡矿远景区的研究专著。

本书先论述云开隆起区的区域地质背景，确定区内变质地层属于震旦纪云开群，并提出"云开群 b 组原岩是一套以浅变质海相钙泥质碎屑岩为主混有火山物质的沉积岩层，是本区锡多金属矿源层"的观点。

云开隆起区位于吴川—四会断裂带和宋桂断裂带之间的贵子弧形构造带上。它经历了加里东运动、海西—印支运动及燕山运动等多次构造运动，褶被紧密复杂，断裂十分发育，伴随这些构造运动而出现的有加里东期混合岩、海西—印支期花岗岩及燕山花岗岩及花岗斑岩等。

本书将研究区锡矿划分为四种类型，即斑岩锡矿、云英岩型锡矿、层控锡（铁）多金属矿及脉状锡矿。银岩为本区最主要的锡矿床，该矿体主要为隐伏矿体，地表仅出露有多条石英斑岩脉及块状硅化体，矿体主要产于花岗斑岩岩筒内部，主矿体向四周延伸，中间较浅，呈倒杯状分布于 900～1 100m 之间，主矿体下部尚有钨、锡、钼综合矿体，银岩斑岩锡矿规模大，属于大型矿床。锡石在矿石中以浸染状及细脉浸染产出，围岩蚀变自下而上呈带状分布，为钾化、黑鳞云母云英岩化、硅化黄玉化（即黄玉云英岩化）、硅化斜绿泥石化、赤铁绢英岩化、高岭土化及石英块状体等，本区锡矿床为国内最典型的斑岩锡矿。

云开隆起区的银岩，与武夷山的岩背（及诸广山西部千里山野鸡尾斑岩锡矿）均产于隆起区，属于大型矿床，从而有别于大厂、个旧等超大型层控锡石硫化物多金属矿床，后者则产于以石灰岩岩层为主的坳陷区内并与拉伸型深断裂相伴随。

另外，云英岩型锡矿、层控锡（铁）多金属矿及脉状锡矿各有其特点，均与燕山晚期陆壳改造型花岗岩等有关，不过具体控矿条件不同罢了。

本书在对各类型锡矿的描述中，均使用了大量的岩石学、岩石化学、地球化学、稀土与稳定同位素等分析测试数据。

本书并初步建立了锡多金属的成矿模式，总结出该区锡矿床的成矿规律和找矿标志，并在此基础上，结合物化探成果，提出了找矿远景预测区，对今后指导找矿有重要的参考价值。书中所附云开隆起中段（信宜—罗定一带）锡矿成矿规律图是一幅很有参考价值的图件。

希望本书的出版，能进一步促进锡矿的找矿和勘探工作。

1990 年 11 月

前　言

锡矿是我国优势矿种之一。粤西南云开隆起区中段的信宜—罗定一带是广东省锡矿重要产区，多为中小型的云英岩型，层控矽卡岩型及脉型锡矿床或矿点。十年前，银岩锡石–硫化物脉型矿床之下发现了大型斑岩锡矿，为在该区寻找新的斑岩锡矿产地显示出良好前景。因此，开展该地区锡矿成矿规律的研究有重要的理论和实际意义。

工作区内地质研究程度较低，虽然70年代末至今，广东省地质矿产局在区内开展了贵子、罗镜、合水及思贺幅1∶50 000地质测量，但均未正式出版。由于该区地质情况复杂，岩石多已变质，大部分变质地层的层序不清，时代归属不明，罗定分界南北两边的地层对比众说纷纭。区域性的锡矿控矿条件及成矿规律需要深入研究和总结。特别在当前"四化"建设迅速发展，坚持改革开放，深入进行治理整顿取得了新的伟大成绩，找矿难度不断加大的新形势下，深入研究粤西南云开隆起区中段地质特征、锡矿成矿规律及成矿预测，更是当务之需。

本书是在国家"七五"重点科技攻关项目五十五项的一个四级专题《云开隆起区中段(信宜—罗定一带）锡多金属矿床控矿条件及成矿预测》的研究成果的基础上写成的，又是国家自然科学基金资助课题《粤西湘南斑岩锡矿床成矿规律研究》[（84）科基金地准字第011号]的研究成果。主要研究内容为：

① 选择有代表性地段，建立本区变质地层柱子，研究地层时代归属，并进行对比；研究有无锡的矿源层及岩性控矿因素；

② 研究燕山晚期控岩控矿构造，阐明本区含矿岩体及锡矿的构造控制因素；

③ 研究燕山晚期花岗岩、花岗斑岩及石英斑岩的特征和它们之间的演化发展关系以及形成的构造环境。研究含矿岩体与非含矿岩体的区别；

④ 研究各类锡矿的成矿特征，重点为斑岩型锡矿和云类岩型锡矿，岩体蚀变类型及分带、矿化分带以及斑岩型与其他类型锡矿之间的成因关系，建立综合成矿模式；

⑤ 研究成矿各种控制因素及锡矿分布规律，结合物化探资料进行成矿预测。

专题研究自1986年7月下达任务，于1989年10月提交研究报告。广东省地质矿产局及国家"七五"科技攻关项目55–01办公室联合对本专题研究报告进行评审。中山大学地质系李兆麟教授、南京大学地球科学系刘英俊教授、地质矿产部地质勘查管理司张家骥（教授级）高级工程师、广东省地质矿产局科技处主任工程师王绍冲（教授级）高级工程师、地质矿产部宜昌地质矿产研究所史明魁副研究员和广东省地质矿产局704地质大队副总工程师傅昌来高级工程师等评审员对本专题研究报告进行了通讯评审，1989年12月26日通过了鉴定意见。鉴定书认为"云开隆起区是我国重要锡多金属找矿远景区之一，研究工作在系统地收集、整理和综合分析了区调普查、勘探及有关科研资料基础上，进行以了详细的野外调查及室内测试、分析研究等工作，通过三年来的努力，在掌握大量资料的基础上，按照设计要求，编写了本报告，圆满地完成了研究任务。

报告提出区内南北两地变质地层同属震旦纪云开群，并提出云开群 b 组原岩是一套以钙泥质碎屑为主混有火山物质的沉积层，是本区锡多金属矿源层的观点。

报告重点对与成矿有密切关系的燕山期花岗岩做了比较深入的研究，将其划分为两个阶段、并讨论了其成因类型。提出斑岩型锡矿与第一阶段的花岗斑岩、石英斑岩有关，云英岩型等锡矿与第二阶段钾长石花岗岩有关的观点。

报告还提出了本区为北西向鹅鹕岭（阳春）—锡坪（信宜）隐伏断裂带西段的看法，并进而划分并论述了与本区控岩控矿有密切关系的三条北西向隐伏断裂带的性质与分布特点，指出北西向构造、北东向构造与岩体接触带的复合是主要控矿部位。

报告将本区锡矿床划分为四种类型，即斑岩锡矿、云英岩型锡矿、层控矽卡岩型锡(铁) 多金属矿及脉状锡矿。初步建立了锡多金属的成矿模式，总结出该区锡矿床成矿规律与找矿标志，并在此基础上，结合物化探成果提出了找矿远景预测区 6 处（A 级 2 处、B 级 2 处、C 级 2 处）及进一步工作意见，对指导找矿有重要参考价值。

总之，本研究报告内容丰富，资料翔实，立论有据，是一份具有较高学术水平的报告，其成果总体上达到国内同类报告的先进水平，对科研与生产有重要实用价值，同意予以评审通过。建议其上级部门予以奖励，并尽快出版，提供有关部门使用。"

本项科研成果是集体劳动所获，总结报告是集体讨论分工编写而成的。

参加专题科研工作的人员：中山大学地质系（负责单位）：俞受鋆（专题负责人）、陈志中、陆人雄、吴起俊、单惠珍、李强、陈炳辉、陈然、伍尚嘉（硕士研究生）；广东省地质矿产局 704 地质大队（参加单位）；陈易玖。

本书由俞受鋆担任主编，陈志中担任副主编。具体编写分工如下：俞受鋆编写前言、第三章第四节、第五章、结束语及全书定稿工作；陈志中编写第二章第二、三、四节、第三章第一节及全书编辑工作，并与李强共同负责 第 一章第一节统稿工作；陆人雄编写第一章第三节及第三章第三节；吴起俊、单惠珍编写第一章第一节；陈然编写第一章第二节及第三章第二节；陈炳辉编写第二章第一节；陈易玖编写第四章。本区锡矿成矿规律图及预测区由陈炳辉、伍尚嘉、单惠珍编制。

研究过程中曾得到广东省地质矿产局 704 地质大队、719 地质大队、广东省有色金属地质勘探局 933 地质队给予了大力支持，为我们提供了大量的地质资料。中国科学院贵阳地球化学研究所、地质矿产部宜昌地质矿产研究所、有色金属工业总公司桂林矿产地质研究院及地质矿产部湖北省地质实验室、中山大学测试中心等单位承担了分析测试任务，广东省地矿局地质科学研究所南颐高级工程师提供了粤西地层资料。在此，我们谨向以上单位和同志以及所有为本研究专题付出辛勤劳动的同志表示衷心感谢!

作　者

1990 年 6 月

Abstract

This book is about the metallogenic characteristics, ore-controlling conditions, metallogeny and metallogenic prognosis of tin deposits in the middle area of Yunkai Upheaval, western Guangdong province. The main ideas are briefly described below:

1. Regional Geological Background

The middle area of Yunkai Upheaval situated in NW-trending Yinwulin-Xiping hidden fault zone is located in the west side of Wuchun-Shihui fault zone.

The outcropped strata are Quaternary System, lower Cretaceous Series, Lower Carboniferous Series, middle Devonian Series, formation b (Z^b_{yk}) and c (Z^c_{yk}) of Yunkai Group of Sinian System. Z^b_{yk} being widely outcropped in the area consists of slate, quartzose sericite schist, sericitic quartz schist, metamorphosed siltstone, metamorphosed feldspathic quartz sandstone, diopside-actinolite-quartz schist, diopside hornstone, marble, siliceous rocks and some ferruginous beds, etc. The rocks of Z^b_{yk} with low degree of metamorphism belong to green schist facies.

The chief structural framework is Guizi arc structure and NE-trending structures. NW-trending structures distributed mainly in the south side of Guizi arc structure are mostly subterranean. Based on their forming stages, the NW-trending structures can be distinguished into three types such as 1) the Caledonian, 2) the Hercinian-Indosinian, and 3) the late-Yenshanian. Based on the distribution of late-Yenshanian granitoids and geophysical studies, it can be infered that there are three late-Yenshanian NW-trending hidden fault zones which, from west to east, are Bodong-Yinyan hidden fault zone, Longwan-Xipin hidden fault zone and Tuopangdong-Linwan hidden fault zone. The three NW-trending fault zones form a larger Yinwulin-Xipin hidden fault zone.

Besides Caledonian magmatic rocks and different periods of dikes, the chief magmatic rocks are Hercinian-Indosian granites, monzonic granites and late-Yenshanian granitoids. The late-Yenshanian granitoids occurring in small stocks or bosses with K-Ar isotopic ages of 57.9 to 92.27 Ma intruded into Z^b_{yk}. They are distributed in the Yinwulin-Xipin hidden fault zone and are related with tin deposits. Based on their intercalated and intrusive contacts, they can be divided into two stages: The first stage rocks are granities- porphyry and quartzs- porphyry and the second stage ones are medium-to fine-grained moyites. The petrochemical compositions of the two stage rocks are of the same characteristics of high magmatic acidity, high degree of magmatic evolution and low contents of Mg and Ca. From the first stage to the second one, the evolution

is showed as follows: 1) Micas change from siderophyllite to protolithionite; 2) SiO_2 changes from 75.83% to 75.29%, Na_2O+K_2O from 7.00% to 8.02% and DI value from 89.86 to 91.35; 3) Contents of Sn and Mo increase; 4) Rock-forming temperature changes from 780℃ to 740℃ and P_{H_2O} from 70 to 90 MPa, 5) Emplacemental depth decreases; 6) REE turn from "Abundant Ce Type" to "Abundant Y Type". The late-Yenshanian granitoids with "V" type of REE distribution line, high initial stroutium isotopic ratio ($^{87}Sr/^{86}Sr = 0.713$) and oxigen isotopic value $\delta_{18_O} = +9.55 \sim 12.98‰$ were originated from the upper Crust and formed in extensional tectonic setting within plates.

2. Metallogenic Characteristics of Tin Deposits

The tin deposits are closely related with the late-Yenshanian granites-porphyry or moyites in space and genesis. They can be distinguished into four types such as porphyry type, greisen type, stratabound skarn type and vein type that are described below:

(1) Tin Deposits of Porphyry Type, eg. Yinyan Deposit. The orebodies accompanying with Mo and W mineralization occur in interior and contact zone of hidden granite-porphyry, intrusion of the first stage of late-Yenshanian Period. The ores with disseminated or veilet-disseminated structures are composed of metallic minerals such as cassiterite, wolframite, molybedemite, bismuthinite, chalcopyrite, pyrite, sphalerite, specularite, arsenopyrite, galena, bismuth, scheelite and non-metallic minerals such as quartz, topaz, siderophyllite, clinochlorite, fluorite, sericite, kaolinite, epidote, monazite, etc.

Alteration and mineralization zoning of the deposit is apparent. It can be distinguished, from bottom to top part of the granite- porphyry pipe, as K- feldspathization superposed line greisenization- weak Sn, W, Mo mineralization zone, greisenization-topazization-W(Sn, Mo) mineralization zone, silicification-topazization-Sn(Mo) mineralization zone, silicification-clinochloritization-Sn (Bi) mineralization zone, hematite-phyllitization-Cassiterite-sulfide vein zone and secondary quartzization zone.

Based on Pb, O, H isotopes and REE relevance of the ores and the granite-porphyry, ore-forming substances and hydrothermal solution were originated from granite-porphyry magma.

(2) Tin Deposits of Greisen Type. This type of tin deposits such as Dayin tin deposit in Xinyi county and Damoshi, Shipai, Dahualuo, Mingzhikeng and Dafu tin deposits in Luoding county are related to moyites, intrusions of the second stage of late-Yenshanian

Period. The orebodies occur chiefly in planar greisenization zone in the area at the top of moyitic bodies. The ores with disseminated or veinlet structures are of main mineral assembleges of cassiterite–quartz–protolithionite–topaz. The metallic minerals are cassiterite, wolframite, molydbenite, chalcopyrite, pyrrholite, pyrite, sphalerite, galena and bismuthinite and the non–metallic minerals are quartz, protolithionite, topaz, fluorite, chlorite, sericite, arsenopyrite, sphene, xenotime and apatite.

The chief wallrock alteration is greisenization accompanying with topazization and chloritization. Weak albitization and K–feldspathization may be found below the planar greisenization.

Based on Pb isotopes, REE relevance of moyites and ores, the ore–forming substances were derived from the moyitic magma.

(3) Sn–Fe Deposits of Stratabound Skarn Type. The deposits such as Shanchaken deposit in Xipin, Qiufengen and Tuopangdong deposits near Dayin, Dengzhan and Duimianhe deposits near Qishan are distributed in southwestern Luoding and northeastern Xinyi area and most of them are in small scales. Small intrusions of late–Yenshanian granitoids can always be found near the deposits. The lentoid or stratoid orebodies occur in interstratal skarns, which are widely distributed from near contact zones of the intrusions to areas a few miles away, in the middle rock series of Z^{b}_{yk}. The ores with disseminated or network structures consist of metallic minerals such as magnetite, cassiterite, specularite, hematite, pyrite, pyrrhotite, chalcopyrite, sphalerite, galena, bornite, stanite, psilomelane and pyrolusite; skarn minerals such as garnet, diopside, vesuvianite, hornblende, epidote, tremolite, actinolite, chondrodite and other non–metallic minerals such as quartz, feldspar, flourite, mica and chlorite.

The main alteration occurring in the calche or calcic–argillacous beds is skarnization superposed by episodization, chloritization and pyritization.

(4) Tin Deposits of Vein Type. They include cassiterite–sulfide vein or cassiterite–chlorite–sulfide vein, cassiterite–quartz vein and cassiterite–greisen vein types of deposit occurring in internal or/ and external contact zone of the intrusions of late–Yenshanian granitoids. Most of them such as Yinyan, Xipin, Dayin, Shipai, Qishan, Tuopangdong and Bodong vein type deposits are located in metamorphosed wallrocks in ore districts where granite–porphyry or/ and moyites occurred. The mineral assembleges of ores are very variable at different ore districts. As a whole, they are composed of metallic minerals such as cassiterite, wolframite, magnetite, specularite, pyrrhotite, pyrite, sphalerite, chalcopyrite, galena, molydbenite, arsenopyrite and non–metallic minerals such as tourmaline, topaz, fluorite, quartz, chlorite, episode, mica and garnet, etc. The wallrock alterations are greisenization, tourmalinization, chloritization and silicification, etc.

3. Ore-controlling Geological Conditions of Tin Deposits

(1) Strata and Lithological Condition. All types of the tin deposit distributed in Z_{yk}^{b} are controlled by the strata. The stratabound skarn type Sn-Fe deposits are most apparently controlled by Z_{yk}^{b}, and the other three types of tin deposit, to certain degree, are also controlled by the strata. The Z_{yk}^{b} can be distinguished into three rock series. The lower rock series consists of grey, grey-green or purple thin-bedded phyllite, quartzose mica schist, micaceous quartz schist, metamorphosed feldspathic quartz sandstone, intertratification of lentoid siliceous rocks and marble lens, and thin- bedded intertratification of striped episodic diopside schist. The middle one is composed of gray- white, grey- green metamor phosed feldsparthic quartz sandstone, phyllite, two- micaceous quartz schist, episode- actinolite- quartz schist, thick- bedded interatification of episodic diopside schist and ferruginous beds. The upper one consists of intertratification of grey-white, yellow-brown medium-to thick-bedded metamorphosed feldspathic quartz sandstone and grey-purple, grey-green thin-bedded quartzose mica schist and micaceous quartz schist. The stratabound skarn Sn-Fe deposits occurring mainly in the middle rock series are directly controlled by the episode-actinotite-quartz schist and episodic diopside schist of the series. Based on chemical analyses of 36 specimens from Fenjie-Luola section of Z_{yk}^{b}, the average tin content is 4.68 ppm which is three times larger than the Clarke value and that of the middle rock series is 6.1 ppm. The result indicates that tin was preliminary accumulation in the middle rock series of Z_{yk}^{b} during its sedimentary stage, forming ore source layer. And it was further accumulated by the superposed magmatic hydrothermal solution of late-Yenshanian period, forming stratoid or lentoid skarn type Sn-Fe deposits. The late-Yenshanian granitoids associated with the other types of tin deposit also intruded into the thick- bedded episode-actinolite-quartz schist and marble lens of the middle rock series. The granitoids are advantageous to form tin deposits by extracting some ore-forming substances from the middle rock series. As a conclusion, the middle rock series of Z_{yk}^{b} is also ore source layer of the other types of tin deposit. It controlled, to certain degree, the formation of all the tin deposits in the area.

(2) Structure Geological Condition. The emplacements of the late-Yenshanian granitoids, which are distributed apparently in the three NW-trending fault zones mentioned above, are controlled by the composite structures of NW and NE or EW-trending faults. For examples, Yinyan intrusion is chiefly controlled by the composite fracture of NW and EW-trending fault. The isopiestic figure of ΔT in Yinyan district also indicates that the granite-porphyry pipe is located in the intersection of EW-trending lined negative anomaly and NW-trending lined negative anomaly. Guilong, Qiufengeng and Shiwuken intrusions are controlled by the composite fracture of NW and NE-trending faults. Xipin intrusion is also controlled by the composite fracture of NW and NE-trending faults. The three NW-trending faults are also important ore-controlling structures which controlled

the distribution of the tin deposits. The occurrences of certain orebodies depend on the tectonic conditions of the ore districts. The greisen type orebodies in ore districts around Qiufengen, for example, are apparently controlled by the fractures. The main orebodies are located in the contact zones of the intrusions. They do not occur, however, in the whole contact zones but in the intersection of the contact zones and the NW-trending faults or NE-trending faults. Orebodies in Dayin, Damoshi, Shipai and Mingzhiken ore districts occurring in the intersection of the NW-trending faults and the contact zone of the moyitic intrusions are controlled by the composite fractures. Orebodies in Shiwuken, Dafu and Tianliao ore districts located in the intersection of NE-trending faults and the contact zones of the intrusions are also controlled by the composite fratures.

(3) Magmatic Condition. Tin deposits especially the porphyry type and the greisen type occurring directly in the interior or internal and external contact zones of the late-Yenshanian granitic bodies are closely related to the granitoids in time, space and genesis and are apparently controlled by the magmatic condition. The ore-bearing granitoids are characterized by follows:

① All of the ore-bearing granitoids outcropped in small scales such as little opophyse or boss or camouflaged as hidden rock bodies were formed in the late-Yenshanian period. Granitoids with less scales and more complicated shapes such as Yinyan and Xipin granitoids are comparatively advantageous to mineralization.

② The higher the evolution and differentiation of magma is, the better the mineralization is. The multistage bodies with high degree of differentiation are generally advantageous to mineralization. Both of the ore-bearing granitic bodies of Yinyan large-sized porphyry tin deposit and Xipin medium-sized greisen tin deposit, for examples, are composed of the granites-porphyry and quartzs-porphyry of the first stage and the moyites of the second one. The differtiation indexes (DI) of them (Yinyan granite-porphyry: 92.20, Xipin granitle-porphyry: 94.26) are larger than the average of ore-bearing granitoids in the area and the solidification indexes (SI) of them (0.84, 0.29) are smaller than the average. Intrusions such as Bajiao and Xinbao bodies with lower evolutionary degree composed only by granites-porphyry of the first stage are not related to mineralization. The identification criteria for ore-bearing bodies in the area may by $DI > 91$ and $SI < 1.50$.

③ Ore-bearing rocks are supercidulated rocks rich in SiO_2, K_2O+Na_2O and poor in Ca and Mg. The average composition of the ore-bearing granitoids is SiO_2 75.29%, Na_2O+K_2O 8.02%, MgO 0.14%, CaO 0.50% and that of late-Yenshanian granitoids without mineralization is Na_2O+K_2O 6.49%, Na_2O 1.60%. Additionally, low ratio value of Mg / Li may also be an important criterion for ore-bearing granitoids.

④ Ore-bearing rocks are of high initial strontrum isotopic ratio ($^{87}Sr/^{86}Sr > 0.710$) and oxigen isotopic value ($\delta^{18}O > 10‰$) and total amount of rear earth elements (ΣREE). The rocks with characteristics of the chondrite-nomalized

patten of REE with an apparently negtive Eu anormaly and in a form of slightly left–sloped "V" type were originated from the Crust and formed by remelting the Crust materials.

Based on the metallogenic characteristics and the ore–controlling conditions, a metallogenic model of tin deposits was summarized.

Besides all described above, different methods of geophysical and geochemical prospecting were applied to prospect the different types of hidden tin deposit and criteria of geophysical and geochmical prospecting were summarized. Furthermore, various types of prognostic target such as types A, B and C were distinguished and discussed.

目　录

CONTENTS

第一章　区域地质特征

本书所涉及的研究区域范围为罗定县的西南部至信宜县的东北部。西起信宜县贵子镇，东至罗定县罗平镇和信宜县思贺一线，南起阳春县永宁镇的林湾和信宜县钱排镇一线，北至罗定县都门和连州镇，面积约 1 700km^2（见成矿规律图）。在其中又以信宜县的银岩、锡坪、渤垌、秋风根、托盘垌和罗定县的旗山、上赖、龙湾等锡矿分布区为重点研究的工作区。在地质上，这个区域范围包括贵子弧形构造带及大田顶混合岩田的北部，因此地质构造比较复杂、变质地层广泛出露。

第一节　地　　层

本研究区的地层属华南地层分区的罗定小区。长期以来，该地区被认为是变质岩广布，岩浆活动频繁，混合岩化作用强烈的地区。因此要研究该区地层的沉积建造、地层划分、地层对比及时代归属都比较困难，对本区变质地层的时代归属的看法就众说不一了。

该区内的地层研究程度较低，大规模的地层工作是在近二三十年来才开展的，尤其是近期在区内发现了锡多金属和金的矿床之后，地质工作全面展开。先后有广东省地质矿产局属下的区域地质调查大队、704 地质大队、719 地质大队和广东省地质科学研究所，地质矿产部宜昌地质矿产研究所，广东省有色金属地质勘探局属下的 933 地质队和地质研究所，中国人民武装警察部队黄金指挥部十五支队和十六支队，核工业部华南地质勘查局，南京大学地球科学系和中山大学地质系等单位开展过研究工作，积累了大量的资料，提高了区内的地层研究程度。

一、区内变质岩地层的时代及地层层序

(一) 变质岩地层的时代

区内近 85% 的面积为变质地层，由于一直未发现可靠的古生物化石，因此对这套变质地层的时代有各种不同的认识和意见，认为属于晚泥盆世或下古生代、晚元古代的看法都有人提出过。

1931 年徐瑞麟、蒋容①将罗定、云浮地区的变质岩和混合花岗岩分别划为前寒武纪-寒武纪变质岩系和太古代片麻岩。

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①徐瑞麟、蒋容，广东西江沿江地质矿产，两广地质调查所，1931。

1964年开展1∶20万罗定幅及高要幅地质填图时①，将这套浅变质岩的时代定为晚泥盆世，创名"南盛组".

1962年云开大山工作组②在粤西云开地区一带进行变质岩的时代及成因研究后，认为这套片岩很可能为寒武纪早期.

1963年开展1∶20万阳春幅③地质调查时，把在罗定分界以南出露的这部分变质岩定为寒武系八村群，而在分界以北出露的部分定为奥陶系和下志留统.

1968年广东省综合研究大队编制1∶50万广东省地质图时④，又将"南盛组"地层划为寒武系.

1974年出版的《中南地区区域地层表》[1]，把本区这套变质地层划归早古生代.

1977年广东省区调队重编1∶50万广东省地质图时⑤，把分界以南这套浅变质岩地层改为震旦系，并划出四个岩性组.

1981年广东省地矿局地质科学研究所构造组⑥在云浮县南盛、茶洞一带的浅变质岩中再次采获孢粉化石，经鉴定其时代可能属晚古生代.

1977年广东省区调队开展1∶5万贵子幅填图时⑦，将贵子幅内出露的这套浅变质岩地层的时代仍定为寒武纪，而1983年719地质队在测制1∶5万罗镜幅地质图时⑧，采纳了1∶20万阳春幅的划分方案. 1984～1987年区调队开展1∶5万合水、思贺幅地质填图时，在思贺幅东南部的秋风坪，在浅变质岩石中发现产于长江三峡地区下震旦统莲沱组的古片藻化石. 据此区调队把合水、思贺幅出露的浅变质岩地层全部划入震旦系，创立"云开群".

1988年陈挺光等在《粤西浅变质岩的时代探讨及构造分析》⑨一文中，把这套浅变质岩地层的时代归属于晚泥盆世，划为"南盛组".

1988年南颐在《粤西信宜冻水坑发现晚元古代微古植物化石》⑩一文中，依据微古植物化石和Rb-Sr同位素等时线年龄828Ma的数据，认为这套变质地层的时代相当于我国北方青白口纪的晚期，而且还认为粤西云开群的时代不限于震旦纪，可能还含有青白口纪甚至更低层位的地层.

我们在野外工作过程中曾在分界至罗罅的剖面、分界至罗光水库的剖面及都门湘垌水库附近的剖面中都采集过微古植物样品，但经分析未发现化石. 在缺乏古生物化石的情况下，我们只能根据前人有关资料及采用岩石地层学的方法来讨论该地区出露的浅变质岩地

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①广东省区调队，1∶20万罗定幅及高要幅地质图及说明书，1964.

②云开大山工作组，云开大山变质杂岩的时代及成因问题，广东地质通讯，1962.

③广东省区调队，1∶20万阳春幅地质图及说明书，1969.

④广东省综合研究大队，1∶50万广东省地质图，1968.

⑤广东省区调队，广东省1∶50万地质图及说明书，1977.

⑥陈挺光，广东西部罗定、云浮一带变质岩的时代讨论及其构造特征，广东地质科技，1983，第2期.

⑦广东省区调队，1∶5万贵子幅地质图及说明书（初稿），1977.

⑧广东省719地质队，1∶5万罗镜幅地质图及说明书（初稿），1983.

⑨陈挺光等，粤西浅变质岩的时代探讨及构造分析，广东地质研究所汇刊，1988，第5期.

⑩南颐，粤西信宜冻水坑发现晚元古代微古植物化石，广东地质科技快报，1988，第3期.