



Guidebook

Society of Economic Geologists Foundation, Inc. Student-Dedicated Field Trip Course – IOCG and Copper-Silver Districts of Northern Chile

March 19 - 25, 2011

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SEGF Student-dedicated Field Trip Course IOCG and Copper-Silver Districts of Northern Chile

Welcome to the Society of Economic Geologists Foundation, Inc. Field Trip Course – IOCG and Copper-Silver Districts of Northern Chile, March 19 to 25, 2011. This field trip course is the eighth in Society of Economic Geologists Foundations Series that was established as a response to a student petition at the at the recent SEG Conference held in Keystone, Colorado, to provide more support for field trips to important mining districts.

The course starts in Antofagasta. An organizational and safety meeting for all participants will take place at 6:00 pm on Saturday the 19th at the Hotel Tatio. The next morning you will pack up and we will depart from your hotel at 6 AM to visit Mina Julia. Roberto Aguilera Rojas will be our driver all week. Sunday evening we will stay in Taltal, a picturesque town on the beach. Tuesday we depart early again to visit the Franke deposit and return to Taltal. Take only what you need for the day. On Tuesday we visit the Manto Verde deposit and head for Copiapó, which will serve as our base of operation for the rest of the trip. On Wednesday through Friday we will visit deposits in the Copiapó area. The field trip course ends on Friday evening with participants departing on Saturday.

Entrance to the mine sites usually follows a specific protocol; please be patient. At the mines we will receive safety training and a geological/engineering presentation. Do not take any pictures of the presentations unless and until we clear this point with company personnel. We will ask, but in general, participants can take pictures and collect samples on company property. Participants are responsible for their own samples (be aware of weight limits if you plan to take samples back with you).

We will have VERY LIMITED . . . REPEAT: VERY LIMITED . . . space for luggage, so you should bring clothing and field gear ONLY IN DUFFLE BAGS - NO HARD-SIDED LUGGAGE. See you in Antofagasta.

Acknowledgements

*This field trip is generously supported through the Society of Economic Geologist Foundation through the **SEGF Student Field Trip Fund**. We also wish to thank the companies that provided access to their operations in Chile and the many company representatives that gave generously of their time to make this trip a success. Special thanks are due to Gordon Putnam, Brian Hoal, John Thoms Vicky Sternicki, , Constantin Isache, Ioan Filip, Nicolae Pop, Roberto Aguilera Rojas, and Mario Carrizo Darlington.*



The Society of Economic Geologists Foundation

Franke

Mina Julia

Amolanas

Mina Carola

Anglo American

Punta del Cobre

Erich U. Petersen

William X. Chávez, Jr.

Estrella Gold Corporation

Equinox Minerals, Ltd.

Gold Fields Australia

NGC

Society of Economic Geologists Foundation, Inc.
“IOCG” and Copper – Silver Districts of Northern Chile
19 – 26 March, 2011

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Date	Itinerary	Overnight
19 March Saturday	<p>6:00 PM: Assemble at Hotel Tatio, Antofagasta Safety and Logistics Meeting for all participants. <u>Lodging:</u> Students: Hotel Costa Marfil hotelcostamarfil@yahoo.es (Sra. Erika Corrales Poblete) – or Danitza Teléfono: 56-55-225569 (oficina) ó -283590 (oficina) ó 269-361 (público)</p> <p>Professionals: Hotel Tatio Avenida Grecia #1000 Telephone: (56-55)-419-111 <consultastatio@123.cl> Contact: Luís Castillo or Alejandro</p>	Antofagasta
20 March Sunday	<p>6:00AM – Depart for Mina Julia Cu-Au vein system; Discuss “ IOCG” styles and classification and ages in northern Chile.</p> <p><u>Lodging:</u> Students: Residencial Paraná Contact: Sr. LLamil Jalil Nara Negrete (dueño): 56-55-613-604 Also: Sra. Rosita</p> <p>Professionals: Hostería Taltal: 56-55-611-173 or FAX: -625 <u>Contact:</u> Nury Cortes/Tanya; Marseilla Cabaña <lorens.caseres34@gmail.com></p>	Taltal
21 March Monday	<p>6:30AM – Depart for Franke andesite-hosted Cu-Ag system; discuss copper systems hosted by volcanic rocks; redox settings.</p>	Taltal
22 March Tuesday	<p>6:30AM – Depart for Manto Verde breccia-hosted copper-(gold) systems. discuss “ what are ‘IOCG’ ore deposits in the Copiapó area?”</p> <p><u>Lodging:</u> Students: Residencial Plaza: Calle O’Higgins No. 670 Telephone: 56-52-212671 <u>Contact:</u> María Cortés Rojas</p> <p>Professionals: Hotel La Casona Calle O’Higgins No. 150 56-52-217-278 or 277 Contact: Pamela <reservas@lacasonahotel.cl</p>	Copiapó
23 March Wednesday	<p>7:30AM – Visit Punta del Cobre Cu-(Fe, Au) system; compare Punta del Cobre mine ore deposits to other Punta del Cobre District systems</p>	Copiapó
24 March Thursday	<p>7:00AM – Visit Amolanas (Lautaro) Cu-Ag volcanic-hosted system; compare this system to distinct Cu-(Au) ores of the Copiapó District.</p>	Copiapó

25 March
Friday

7:30AM - Visit **Mina Carola structurally-controlled Cu-Fe-Au** deposit;
?vein system or “IOCG”? or what?

Copiapó

Evening: Final dinner as SEG F Field Course participants.

26 March
Saturday

End of Course – Participants Return on their own schedules

NOTES:

◆ **Participants must arrive at the Hotel Tatio in Antofagasta by 6:00PM on the 19th of March** for a safety and logistics meeting.

◆ **All participants MUST – REPEAT...MUST - bring hardhat, STEEL-TOE boots, reflective vest, gloves, and eye protection. DO NOT plan to obtain these items during the course, as there is no time to do so!**

◆ **Participants must provide proof of insurance coverage valid in Chile PRIOR** to participation in the course.

◆ All participants must sign a **liability waiver form** that will be provided by SEG F prior to participation in the course.

◆ Participants from the U.S. will be required to pay a one-time **Reciprocity Fee** (around US\$140) as a part of the immigration entrance process into Chile; this is done in the Immigration area prior to entering the lines that lead to the immigration checkpoints.

◆ Participants will need to check on **Chilean visa requirements** well in-advance of their travel to Chile; for some nationalities, the visa may be obtained on the flight to Chile.

◆ All participants will need to submit their passport information (name, country of issue) to SEG F so that this information may be passed along to the mining companies as a part of our mine entrance procedures.

◆ The weather in northern Chile during March is generally balmy and warm; nights may be cool. Please bring layers of clothing for warm days and cool evenings.

STUDENTS:

1. You may change money at the airport in Santiago, either as you enter the Baggage Claim area or upon leaving the Customs area. You will need Chilean money (**do not** count on using a credit card!) for your personal expenses, including some meals, so **change money prior to your arrival in Antofagasta – there will be no time to do so during the field course.**
2. Students are staying at the Costa Marfil hostería in Antofagasta (see address, above) – when you arrive, a room will have been assigned to you, so please use that room for your stay in Antofagasta (one night). The Costa Marfil is walking distance of the bus station in Antofagasta.
3. Students are recommended to purchase a Chile guide or tour book for reference – these guides make your travels within Chile easier, have hints about bus connections and restaurants, and usually contain vignettes on local history and culture.
4. Because we will be staying in hostels, please bring a towel, the usual toiletries, and a facecloth for your use; please pack lightly (easier to travel, too, with less baggage and weight). Laundry is available at the hostels where we will be staying.

Participants

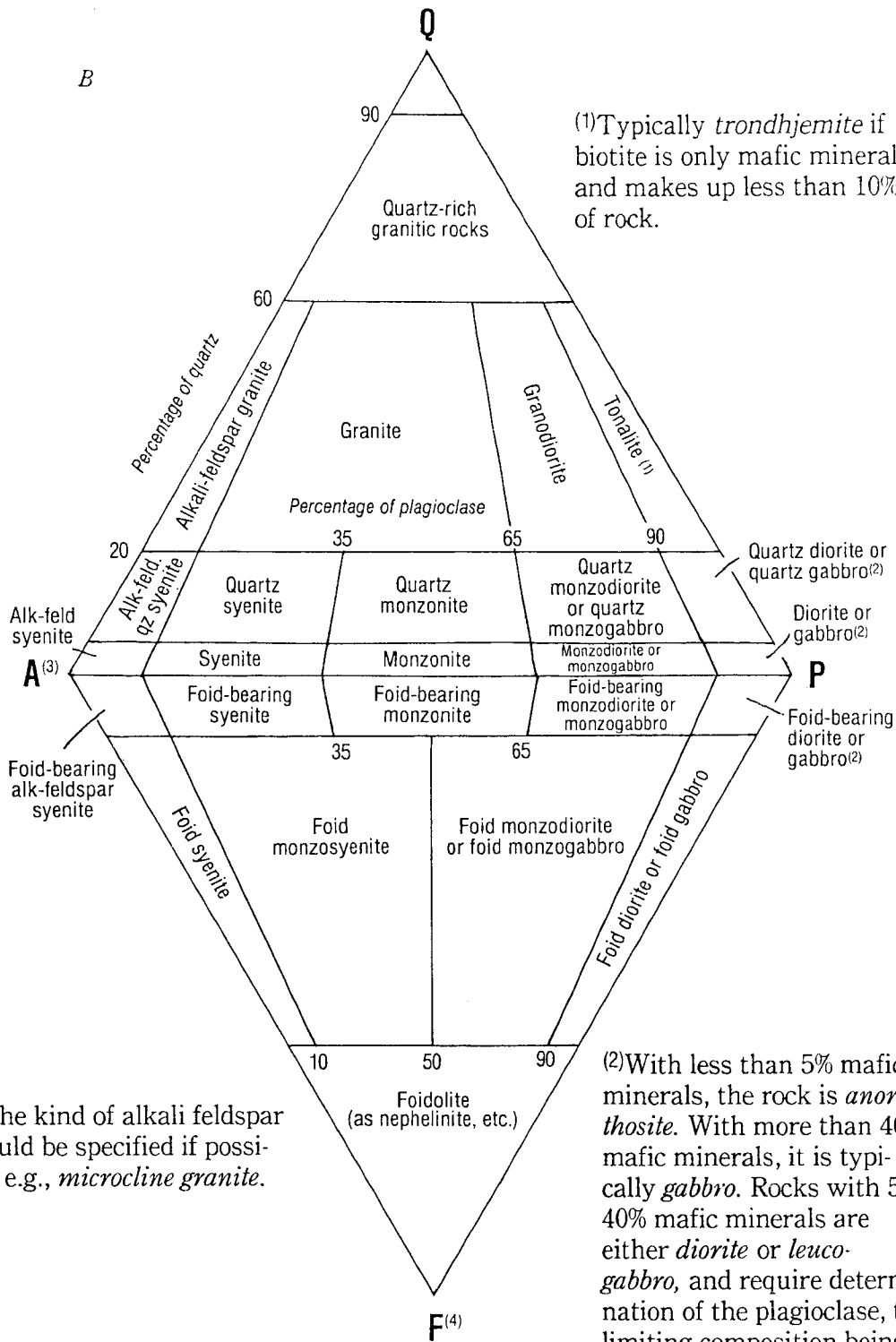
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**Minerals Commonly Found in the Oxide Zone of Copper
Deposits**

Alunite	$\text{KAl}_3(\text{SO}_4)_2(\text{OH})_6$
Antlerite	$\text{Cu}_3\text{SO}_4(\text{OH})_4$
Atacamite (paraatacamite, botallackite)	$\text{Cu}_2\text{Cl}(\text{OH})_3$
Bonattite.....	$\text{CuSO}_4 \cdot 3\text{H}_2\text{O}$
Brochanite.....	$\text{Cu}_4\text{SO}_4(\text{OH})_6$
Ceruleite.....	$\text{Cu}_2\text{Al}_7(\text{AsO}_4)_4(\text{OH})_{13} \cdot 12\text{H}_2\text{O}$
Chalcanthite	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
Chalcosiderite (compare to turquoise).....	$\text{CuFe}_6(\text{PO}_4)_4(\text{OH})_8 \cdot 4\text{H}_2\text{O}$
Chenevixite	$\text{Cu}_2\text{Fe}_2(\text{AsO}_4)_2(\text{OH})_4 \cdot \text{H}_2\text{O}$
Chrysocolla (mineraloid)	$\text{Cu}(\text{Fe},\text{Mn})\text{O}_x \cdot \text{SiO}_2 \cdot \text{H}_2\text{O}$, with copper content varying from ~20-40 wt % Cu
Copiapite.....	$\text{Fe}_5(\text{SO}_4)_6(\text{OH})_2 \cdot 20\text{H}_2\text{O}$
Coquimbite.....	$\text{Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$
Goethite.....	$\alpha\text{-FeOOH}$
Jarosite	$(\text{K},\text{Na})\text{Al}_3(\text{SO}_4)_2(\text{OH})_6$
Kröhnkite	$\text{Na}_2\text{Cu}(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$
Levandulite	$\text{NaCaCu}_5(\text{AsO}_4)_4\text{Cl} \cdot 5\text{H}_2\text{O}$
Libethinite.....	$\text{Cu}_2\text{PO}_4(\text{OH})$
Paramelanconite.....	Cu_4O_3 (see tenorite (CuO) and cuprite (Cu ₂ O))
Poitevinite	$(\text{Cu},\text{Fe},\text{Zn})\text{SO}_4 \cdot \text{H}_2\text{O}$
Posnjakite.....	$\text{Cu}_4\text{SO}_4(\text{OH})_6 \cdot \text{H}_2\text{O}$
Pseudomalachite	$\text{Cu}_5(\text{PO}_4)_2(\text{OH})_4$
Scorodite	$\text{FeAsO}_4 \cdot 2\text{H}_2\text{O}$
Turquoise	$\text{CuAl}_6(\text{PO}_4)_4(\text{OH})_8 \cdot 4\text{H}_2\text{O}$
Voltaite.....	$\text{K}_2\text{Fe}_8\text{Al}(\text{SO}_4)_{12} \cdot 18\text{H}_2\text{O}$
Wroewolfeite (Langite).....	$\text{Cu}_4\text{SO}_4(\text{OH})_6 \cdot 2\text{H}_2\text{O}$

Some Common Mineral Formulas

Chlorite	$(\text{Mg,Fe})_3(\text{Al,Si})_4\text{O}_{10}(\text{OH})_2 \cdot (\text{Mg,Fe})_3(\text{OH})_6$
Biotite.....	$\text{KFe}_3\text{AlSi}_3\text{O}_{10}(\text{OH})_2$
Muscovite.....	$\text{KAl}_3\text{Si}_3\text{O}_{10}(\text{OH})_2$
Kaolinite.....	$\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$
Alkali feldspar.....	$(\text{K,Na})\text{AlSi}_3\text{O}_8$
Plagioclase	$\text{CaAl}_2\text{Si}_2\text{O}_8$
Dumortierite.....	$\text{Al}_7\text{O}_3(\text{BO}_3)(\text{SiO}_4)_3$
Tourmaline.....	$(\text{Na,Ca})(\text{Li,Mg,Al})(\text{Al,Fe,Mn})_6(\text{BO}_3)_3$ $(\text{Si}_6\text{O}_{18})(\text{OH})_4$
Bornite	Cu_5FeS_4
Chalcopyrite.....	CuFeS_2
Chalcocite	Cu_2S
Covellite.....	CuS
Cuprite	Cu_2O
Tenorite.....	CuO

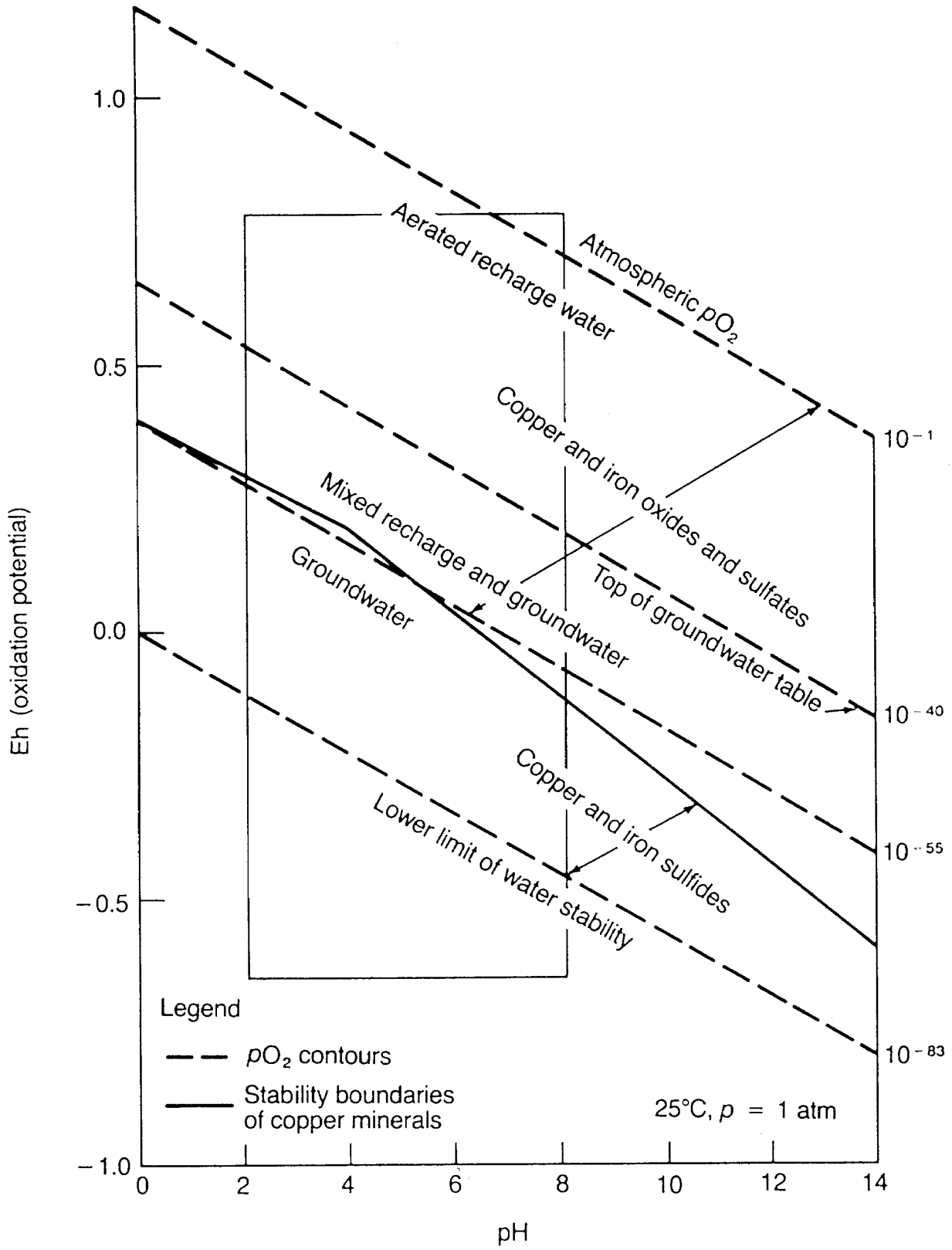


(1) Typically *trondhjemite* if biotite is only mafic mineral and makes up less than 10% of rock.

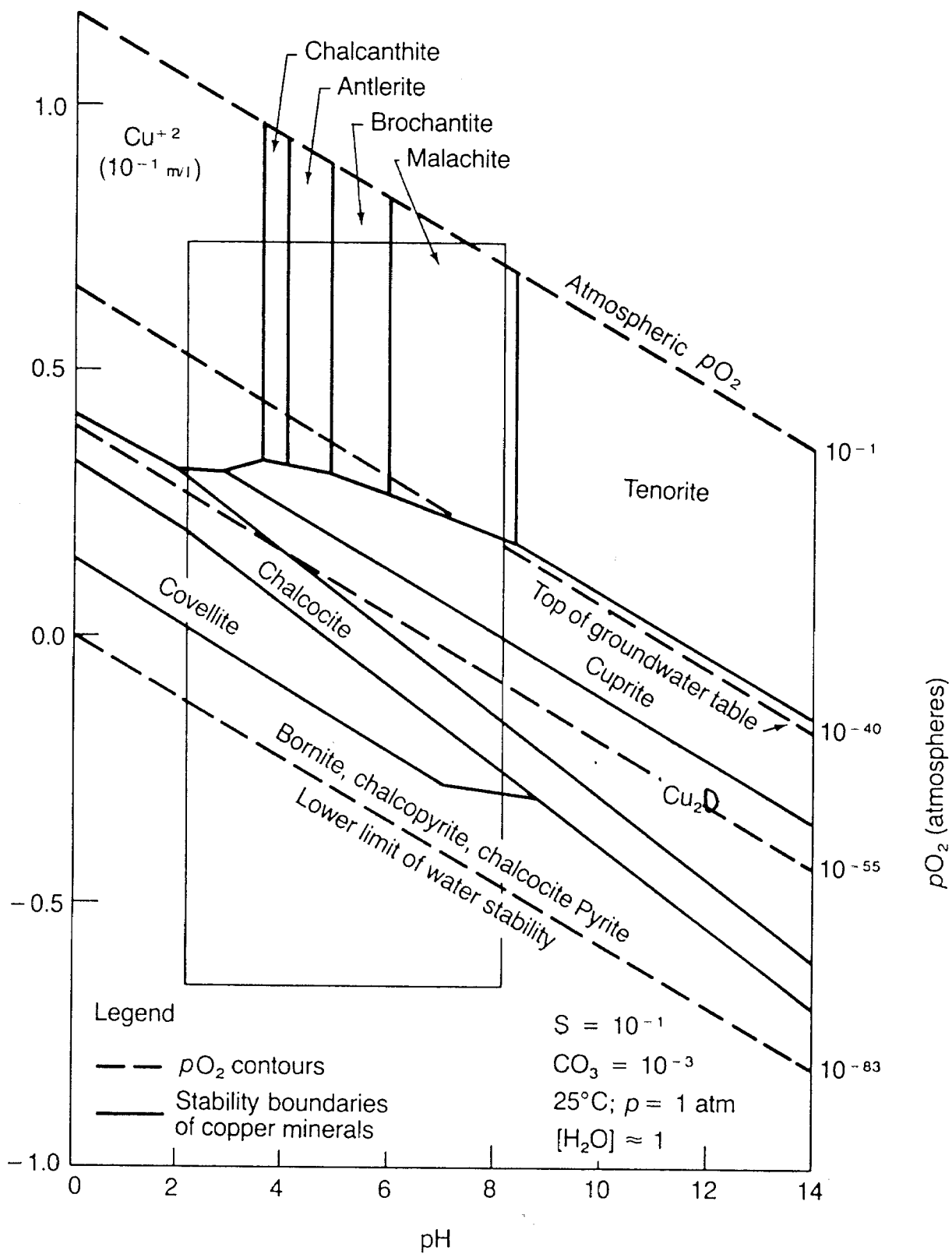
(3) The kind of alkali feldspar should be specified if possible; e.g., *microcline granite*.

(2) With less than 5% mafic minerals, the rock is *anorthosite*. With more than 40% mafic minerals, it is typically *gabbro*. Rocks with 5-40% mafic minerals are either *diorite* or *leucogabbro*, and require determination of the plagioclase, the limiting composition being An_{50} .

(4) The feldspathoid should be specified in each rock name; e.g., *nepheline syenite*.



(a)



(b)

Contacts and other important information

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At the end of the trip, and as soon as possible, please send a brief e-mail to Borden Putnam with a copy to Brian Hoal and John Thoms describing your experience on the trip and acknowledging the support of the Society of Economic Geologists. This is very important, as the feedback received by SEG is critical for the planning of future field course trips. You will also find that maintaining contact in this manner will greatly benefit your career whatever course it may follow. Your note may be in your native language.