35TH INTERNATIONAL GEOLOGICAL CONGRESS

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XXXV GEOLOGORUM CONVENTUS • MENTE ET MALLEO • CAPE TOWN 2016 SOUTH AFRICA

PRE 16

Geology of the Barberton Greenstone Belt: Processes on the early Earth

FIELD TRIP LEADERS:
Christoph Heubeck, Gary Byerly and Don Lowe

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giya ngomhlaba dance with earth

IUGS International Union of Geological Sciences

GSSA Geological Society of South Africa

Council for Geoscience

Under the patronage of UNESCO

United Nations Educational, Scientific and Cultural Organization

Due to its excellent exposure, low-grade metamorphic overprint and considerable extent the Barberton Greenstone Belt, straddling the South Africa - Swaziland border, offers profound insights on Archean processes and events that shaped the evolution of the crust of our planet. These processes include, among others, growth of the early continental crust; the relative roles of horizontal vs. vertical tectonics; controls on the origin, locations, metabolism, and ecology of early life; the nature of magmatism on the early Earth; surface conditions of early Earth, including the composition and physical/chemical state of oceans and atmosphere; non-uniformitarian depositional environments and sediments, early weathering conditions, the early Earth-Moon system, and the role of meteorite impacts in early crustal development and biological evolution.

This trip will introduce participants to many of the principal outcrops, lithologies and styles of deformation of the Onverwacht, Fig Tree and Moodies Groups (3.57-3.21 Ga) and to key lines of evidence on which much of our knowledge of early Earth processes is based. Participants will be based in Barberton and use 4-WD vehicles to access outcrops in the Makhonjwa Mountains. Moderate hiking is required at several stops. The trip begins and ends in Nelspruit from where participants will be shuttled to and from Barberton. The beginning of this trip is set to coincide with the end of the Badplaas Workshop.

Field Trip Leaders: Christoph Heubeck, Don Lowe, Gary Byerly
Start: Participants will be picked up from Nelspruit on Sept 22 and transferred to Barberton
End: Program ends in the evening of Aug. 27. Participants will be transferred from Barberton to Nelspruit early on Aug. 28
Departs: Tuesday, Sept 23, 9 a.m., from Jathira Guest House outside Barberton for first day in the field
Dates: 6 days, Monday 22nd to Sunday 28th August 2016

Detailed Itinerary

Field trip participants are requested to arrive in Nelspruit during daytime on August 22. Arrivals by air will be at Nelspruit-Kruger International Airport about 20 km NW of Nelspruit. Arrivals by bus (e.g., Citybug offers four daily nonstop connections between the OR Tambo airport in Johannesburg and downtown Nelspruit; book at http://www.citybug.co.za/) can be picked up in Nelspruit.
Upon receiving the registration lists, field trip organizers will contact the registered participants by e-mail, query them for their detailed arrival information and organize pickup and transport from Nelspruit to Barberton (Jathira). Ideal arrival times would be around midday.
The field trip will then begin around 5:30 p.m. with a welcoming reception for participants at the Barberton golf club, jointly with a reception marking the end of the "*Field Workshop on the Evolution of early Archaean Granitoid-Greenstone Terranes*" in Badplaas (18-22 August 2016). Field trip participants will be transported from Jathira to the golf club and back.

Detailed program

Topics to be discussed:

- Origin of continental growth; horizontal vs. vertical tectonics; accretion vs. sag; style of deformation
- Controls on the origin, locations, metabolism, and ecology of early life
- Nature of magmatism on early Earth; evidence of subduction, convergent-margin etc.
- Surface conditions of early Earth: Oceans, atmosphere, depositional environments, coastal dynamics, weathering etc.
- Role of meteorite impacts

Day 1
Monday, August 22: Arrival
Arrive in Barberton in the afternoon; transfer of participants from the BGGT workshop; evening program at Barberton Golf Club

Day 2
Tuesday, August 23: Overview of the northern margin of the BGB
The principal objective of this day is to familiarize the excursion participants with the structural fabric and contact relationships along the northern margin of the BGB and to introduce them to some important rock types and their alteration.

There is short driving between stops east and northeast of Barberton, mostly on tarred roads. Total about 84 km

1 Composition and fabric of the Kaap Valley Tonalite in the Barberton sand pit and the Fairview road cut
2 Contact relationship of KVT with BGB at the R40 Bulembu Road
3 Ductile strain at the northern greenstone Belt margin at Ezzy's Pass Conglomerate
(4 Absent strain in nearby Moodies tidal bundles in lower Fig Tree Creek; length of the Archean month)
5 Mining geology of Golden Quarry at Sheba Mine
6 Sheba Fault zone
(7 Verdite and the Jamestown Schist Belt)
Return to Barberton

Day 3
Wednesday, August 24: The Buck Reef Chert Member of the Kromberg Formation and related Holocene Iron-oxide deposits
The main objective of Day 2 will be to examination a classic section of the Buck Reef Chert, including evaporitic, platform, and basin facies. The outcrops also include extensive exposures of both surface and subsurface facies of a major Holocene iron-depositing hydrologic system that will further help in evaluating the role of Archean versus modern hydrothermal processes in iron deposition
within the BGB.

All-day moderate hike through rocky grassland, following a 1-hr drive (35 km and back)

1 Overview point
2 Black-and-white chert, silicified sandstones and evaporites of the lower Kromberg Fm.
3 Platform-to-basin transect in the Buck Reef Chert
4, 5, 6 Iron-oxides and recent landslides
Return to Barberton

Day 4
Thursday, August 25: Barite Valley: The Fig Tree Group
We will drive into the central part of the BGB to an area known as the Barite Valley. The Mapepe Formation of the Fig Tree Group in this area includes thick, clastic sections of conglomerate, sandstone, and shale, tuffaceous rocks and interbedded units of barite, jasper, and chert. Spherule beds S2 and S3 are widely developed. We will discuss the relationships among impact processes, spherule-bed deposition, and crustal development.
Ca. 1 hr drive to the first outcrop; several short, moderately strenuous hikes
1 Fig Tree sedimentation style, barite
2 Impact-related sea floor fracturing; chert dikes
3 Impact layer S2
4 Contact relationships between Mendon and Mapepe Fms.

5 Mapepe Fm. and spherule bed S3 on the east side of Barite Valley
Return to Barberton

Day 5
Friday, August 26: Traverse across the central Barberton Mountain Land along the R40 road (Geotrail)

We will study lithologies and facies of Onverwacht and Fig Tree Moodies Group volcaniclastics and sediments, respectively, and of Moodies Group sandstones. They provide information on Archean volcanism, ocean and atmospheric composition, on deep-water and nearshore depositional dynamics, and on the emerging biosphere. The second aspect of the day will be to examine the large-scale structural style in the central Barberton Greenstone Belt and its relationship to synsedimentary tectonics in the Moodies Group.

Ca. 1 hour drive to the first and most distant outcrop; then in short drives back to Barberton. One short hike.

1 Msauli Chert lapilli tuffs of the upper Kromberg Formation
2 Ferruginous and siliceous sedimentation styles in the lower Fig Tree Group
3 Lebombo Mountains overview
4 Inyoka Fault Zone of the central BGB overview
5 Structural style in the central BGB at Heemstede Syncline View
6 Stratigraphic and sedimentary setting of Moodies microbial mats
7 Syndepositional deformation, Saddleback and Dycedale Synclines, Moodies Group
8 Alluvial-to-tidal depositional environments in the Moodies Group, Dycedale Syncline
Return to Barberton

Day 6
Saturday, August 27: (Ultra-)mafic magmatism in the northern BGB
We will examine two major volcanic units of the northern Barberton greenstone belt: 1) komatiitic flows and ash layers in the Weltevreden Formation of the Onverwacht Group, and 2) proximal dacitic breccias and conglomerates of the Schoongezicht Formation of the Fig Tree Group. These units have some of the freshest volcanic materials found in the BGB, including fresh olivine and melt inclusions, fresh spinel, pyroxenes, and amphiboles.

We will drive for approximately one hour to Stop 1.

1 Fresh komatiites of the Weltevreden Fm. near old saw mill on Queens River
2 Emmenes Complex with crossbeds and convolute bedding in komatiitic tuffs
3 Lunch along Queens River on pavements of KVT; lunchtime discussion of TTG and dacitic volcanism.
4 Thick layered/fractionated komatiitic flows, interbedded tuffs, and basaltic komatiites of the Pioneer Complex. Hike with brief stops.
5 Moodies Hills above Pioneer Complex. Proximal dacitic volcanism the Schoongezicht Formation, overlying Moodies conglomerates

Return to Barberton; evening social.

Day 7
Sunday, August 28: Departure
Transfer of participants to Nelspruit in the early morning. Many participants will catch one of the citybug bus departures at 06:00 or at 10:00 to OR Tambo airport (Johannesburg; arrival there at 09:30 or 13:45, respectively) to continue from there to the IGC icebreaker in Cape Town in the evening.

ITINERARY

DATE	ROUTING
22 AUGUST 2016	Jathira Guesthouse in Barberton (*BB)
23 AUGUST 2016	Jathira Guesthouse in Barberton (*BB)
24 AUGUST 2016	Jathira Guesthouse in Barberton (*BB)
25 AUGUST 2016	Jathira Guesthouse in Barberton (*BB)
26 AUGUST 2016	Jathira Guesthouse in Barberton (*BB)
27 AUGUST 2016	Jathira Guesthouse in Barberton (*BB)
28 AUGUST 2016	DEPARTURE
	END OF TOUR

ACCOMMODATION

22 & 28 AUGUST 2016 Overnight at Jathira Guesthouse in Barberton

Meal Key

BB	Bed and Breakfast
DBB	Dinner, Bed and Breakfast
DBB+	Dinner, Bed and Breakfast plus one additional activity
DBB++	Dinner, Bed and Breakfast plus two additional activities
FB	Full Board (includes 3 meals per day)
FB+	Full Board (includes 3 meals per day) plus one additional service
FB++	Full Board (includes 3 meals per day) plus two additional services
FI	Fully Inclusive (includes all meals and local drinks), plus all activities

Vehicles:

4 x 4 Vehicle and driver costs have been included in the pricing

COST INCLUDES:

- 6 x Nights at Jathira Guesthouse in Barberton
- 6 x lunch
- 5 x dinner
- Transport in 4x4 vehicles with appointed drivers

COST EXCLUDES

- All airfares, air reservations and airport taxes
- All other accommodation
- All other meals
- All other transport
- All other sightseeing
- Personal expenses such as tips for meals, gratuities for guides & drivers, all alcoholic and other beverages, telephone calls and laundry
- Any other services not mentioned above