FIELD EXCURSION

Saturday, 23rd October 2010 to Monday 25th October 2010

Note: detailed descriptions of Belingwe and Bougai can be found on the conference CD

Guide: A Martin

STOP 1: MANJERI FORMATION TYPE SECTION, UNCONFORMITY EXPOSURE

Location:

Situated 9.4km SSE of Zvishavane. As a poaching prevention measure, the gate to this exposure is normally locked and arrangements should be made with the ranch manager, whose headquarters are east of the Buchwa Road, some 5km from Zvishavane. The exposure may be reached by a track leading NW from the Buchwa Road, some 1.2km south of the Shavi River; 1.8 km along this track is a road leading to the SW which is followed for 0.8km. A path leading due west passes over a fence and on to the outcrop.

Purpose:

To see the unconformable contact between granitic basement and the Manjeri sedimentary succession as well as to examine the Manjeri type locality. The Reliance volcanic rocks above the succession are also of interest.

Description:

This exposure is described in detail by Martin (1978) and Bickle et al. (1975) and only a summary is given here.

The sedimentary succession here is 130m thick with the lower part dominated by argillite and quartzite and ironstone and the other 80m by siltstone and argillite. All lithologies are metamorphosed to lower greenschist grade and non-metamorphic nomenclature is used where convenient.

The lowest unit is a chaotic brecciated argillite which fills a small channel in the granite floor and in part overlies what was assumed to be a mafic xenolith in the tonalite, but is more likely to be an unbedded part of the channel fill. A conglomerate is the lowermost discernible sedimentary rock on the palaeofloor. The pebbles are mostly of vein quartz with lesser tonalite (flattened, pale olive green) clasts and dark (carbonaceous?) argillite. The matrix is sandy and pale brown and grades over 2m into tonalite to the east. The foliation in the tonalite, defined by elongate quartz grains, lies at a shallow discordant angle to the sedimentary banding.

Overlying the basal units are 6m of sandy argillite with conglomerate bands (one containing a chromite pebble) and an argillaceous dolomite. The argillites show two cleavages, the dominant one parallel to bedding. Truncations of bedding give rise to flaser bedding which are generally enhanced by weathering. Within this unit is a small neptunian dyke. Sericite and quartz are the major components with lesser chlorite and accessory tourmaline and hematite. Dolomite with sericite and quartz constitute the carbonate bands.

Above the predominantly lower argillaceous unit are oxide facies iron-formation beds and quartzite with minor conglomerate bands. The quartzites typically consist of angular to sub-rounded grains of quartz as single crystals and granular mosaics to 1.5mm across in a matrix of fine granular quartz with sericite and some siderite and chlorite. Small scale cross bedding is common but best exposed on weathered surfaces. The iron-formation consists of alternating chert and magnetite layers, the latter being partly altered to haematite near surface. The conglomerates differ from those lower in the succession, in that they contain BIF cherts in addition to quartz. Siderite and sericite are common in the silty matrix to the clasts.

Above the well-exposed lower argillites, arenites and BIF is a relatively thick succession of thin bedded siltstone and argillite, with low angle current truncations of bedding and graded units. Capping the Manjeri Formation at this locality is a narrow unit of sulphide facies iron-formation now a gossan. Folded vein quartz within this unit attest to deformation along this contact with the overlying Reliance Formation. However, core drilling across the whole succession shows an interfingering of sediments with the Reliance volcanics, and some sandy units and sulphidic bands sandwiched between mafic flows. Above the sedimentary sequence, komatiitic basalts showing spinifex textures (clinopyroxene) and flow top breccias are exposed. In addition, spherical structures which are thought to result from accumulation of early formed pyroxene around a ball of more viscous magma, can also be observed.

STOP 2: RELIANCE FORMATION TYPE SECTION

Location:

The Buchwa Road from Zvishavane is followed for 20km to the Railway Road, which turns off east along the railway line. Some 3.8km along this road and beyond Brest Siding (barely visible) the access road crosses the railway line and briefly follows it on the south side. This road is followed in an easterly and then SE direction on the north side of the Rupemba Ridge for 5km (do not take a more prominent south turn) where it passes on to the Type Section at its mid-point with the basal units to the south.

Purpose:

To view the komatiitic lithologies of the Reliance Formation and discuss their importance to the stratigraphy as a whole.

Description:

The petrography of the Type Section rocks (Martin 1978) and their chemistry (Nisbet et al., 1977) are described elsewhere and detailed information on some of the more magnesian rocks are given by Nisbet et al (1987). This description presents results obtained from a core drill hole which penetrated ultramafic flows 5km SW of Zvishavane.

The accompanying map provides numbers of thin section descriptions in Martin (1978), while the stratigraphic column gives brief thin section description numbers from Nisbet et al., 1977, as well as the MgO content of the flows.

At the base of the Type Section (and depending on the river level) two sheared sulphidic iron-formations of the Manjeri Formation occur. These rocks strike just north of east as a result of a major ESE trending fault. All dips are very steep. The first exposure is a homogeneous, basaltic greenstone consisting of untwined feldspar intergrown with semi-radiating tremolite (MgO = 8%).

In the succeeding 60m, several outcrops of massive and sheared komatiitic basalt (up to 12% MgO) occur, which are assumed to be parts of different flows, although no flow contacts are visible. Some thin sections show “hollow” and “solid” megacrysts of pigeonite set in a groundmass of felted tremolite, whereas others exhibit tremolite needles intergrown with small amounts of interstitial feldspar.

Above these basal units is a 90m thick differentiated flow or sill, the serpentinised lower cumulate zones of which form the only prominent topographic features within the Reliance Formation. The cumulate base contains equant serpentinised olivine set in a felted mass of antigorite (MgO up to 40%) but higher within the green serpentinite zone the intercumulus mineral is augite. Above the dunites and wehrlite is a narrow band of clinopyroxenite succeeded by a quartz gabbro of partly saussuritized feldspar and ragged clinopyroxene, with interstitial quartz increasing towards the top of the unit.

Exposures of the quartz gabbro and the overlying massive komatiitic basalt (spinifex textured in places) are intermittent and small. It is possible that these represent individual, thin flows above the differentiated unit or they may be part of it, representing a drilled upper zone.

Minor, partly sheared tuffs (MgO = 12%), some of which show graded bedding, are succeeded by further massive and pillowed komatiitic basalt flows. Typically the pillowed and massive flows consist

of even aggregates of radiating tremolite with a wavy extinction pattern as an even groundmass cut by laths of chlorite probably after pyroxene (MgO = 11-16%). Some 40m south of the access track a well exposed differentiated flow is exposed, showing most of the spinifex elements described from Munro Township by Pyke et al. (1973), except that clinopyroxene is the dominant mineral, rather than olivine. The base of this flow is enriched with cumulate olivine now wholly altered to antigorite within a tremolite groundmass. Above this the mineralogy is similar, but widely spaced relict skeletal olivine and pyroxene is present, which gives way to a very narrow zone of parallel olivine spinifex. This zone is followed by spectacular clinopyroxene needles which have been deformed, probably by top loading of the partly consolidated flow. (No hammers at this outcrop, please). A section cut normal to these needles shows “hollow” basal sections of clinopyroxene contained by feathery tremolite which also fills the interior of the clinopyroxene. Minor feldspar and some sphene are also present. The random spinifex above has similar minerology and texture in thin section.

Above the main spinifex zone other massive flows occur, and north of the road further narrow flows and zones of clinopyroxene can be seen. It appears that the cumulate bases of the flows tend to be better exposed but there does appear, within the limits of exposure, to be an enrichment of MgO upwards in the sequence.

Near the upper part of the type section several thin flows, bounded by white sheared magnesite (?) occur. Each flow has a bluish basal zone typical of olivine cumulates in the Reliance Formation and a greenish upper zone which was originally more pyroxene rich. Pillows have been interpreted from some of these flows and Nisbet et al. (1977) record larger olivine phenocrysts from pillow centres. However the pillows are difficult to see because of the crumbling nature of the outcrops. The olivines are mostly altered to antigorite and show a variety of skeletal crystal forms described in Nisbet et al. (1977) within a plumose tremolitic groundmass.

The top of the Type Section is roughly half way through the Reliance stratigraphy. Exposure of the komatiites, which form the bulk of the upper part of the stratigraphic column, is generally very poor. However, some small outcrops of olivine spinifex textured flows exist to the SW of Zvishavane and these are described in detail by Nisbet et al. (1987). It is worth noting here that many of the komatiites show fresh relict olivine and it is likely that much of the alteration to serpentinite is due to surface processes, rather than metamorphism.

STOP 3: THE ZEEDERBERGS FORMATION

Locality:

Follow the Railway Road east of the Brest Siding and take the first left turn across the railway line some 500m after the road bends to the north. This track is followed for 2km to just beyond a cattle station. The outcrop is in the Ngezi River, some 500m to the south and downstream.

Purpose:

To see the major rock types within the Zeederbergs Formation.

Description:

The outcrop shows a pavement of pillow lavas with spherulites, some patches of pillow breccia and a tuff band. The pillows are generally about 1-2m in cross-section and some 3-D exposures suggest lengths of 3-4m. The spherulites tend to be concentrically arranged, with some flow units consisting almost wholly of coalesced spherulites. In some pillows the spherulites appear to be located around cooling cracks.

The feldspars in these rocks are commonly saussuritised but clinopyroxene generally survives. The spherulites consist of radiating aggregates of albite in a dominantly tremolitic matrix.

The geochemistry of these rocks is discussed by Nisbet et al. (1977). They contain about 53.5% SiO_2 and 8% MgO. The tuff at this locality penetrates between some of the immediately overlying pillows, but the layer is strongly sheared, a feature of most of the exposed tuffs throughout the belt.

STOP 4: CHESHIRE FORMATION CONGLOMERATES

Location:

Continue north up the Railway Road some 4.0km beyond the turn-off to the Zeederbergs pillows, to Zeederbergs Siding. The best exposures occur in railway cuttings around this area.

Purpose:

To view the basal conglomerates of the Cheshire Formation, the uppermost unit of the Belingwe Greenstone Belt.

Description:

The conglomerates at this locality are derived almost wholly from the underlying Zeederbergs and Reliance Formations. The pebbles range from 15 to 150mm in size and are well-rounded with no apparent imbrication or size grading. Apart from Zeederbergs' clasts, chert and vein quartz are also apparent, but no granitic lithologies appear to be represented. The matrix is dark blue-green and essentially chloritic and the outlines between clast and matrix are blurred in places. No detailed sedimentological work has been done on these rocks.

STOP 5: MTSHINGWE DYKE VIEW STOP

Purpose:

To get a panoramic view of the Lower Greenstones which will not be visited because of time/distance constraints.

Location:

Approximately 20km from Zvishavane on the Bulawayo Road.

Description:

The dominant feature of the view is the distant peak of the uppermost ironstone of the Bend Formation known as Mberengwa. The smaller "false" peak to west is one of the lower ironstones which cap the ultramafic to mafic lava sequence constituting the Bend Formation. The Peak marks the axis of a steeply plunging, NE trending syncline which affects all formations up to the lower parts of the Zeederbergs.

Above the Bend Formation is a locally developed conglomerate and agglomerate of the Koodoovale Formation, which is unconformably succeeded by the upper greenstones.

In the near and middle ground from this vantage point are pyroclastic and mafic rocks of the Hokonui Formation and the low distant hills of the Gurumba Tumba Complex lie to the south and SW.

The view point is supported by a dolerite dyke of Proterozoic age which follows the ESE trend of the Mtshingwe Fault. Extensions of this dyke cut the Great Dyke to the west.

STOP 6: HOKONUI FORMATION VOLCANIC VENT

Location:

Follow a small track to the west, some 5.5km beyond the Ngezi River on the Bulawayo Road from Zvishavane (there may be a multitude of side tracks off this depending on gold small-worker activity in the area). Maintain an approximate NNW direction for a distance of approximately 3.8km to a small vlei area. A small dry creek to the south leads to the Mtshingwe River and the outcrop some 400m from the track.

Description:

An outcrop interpreted as a volcanic vent is exposed in the bed of the Mtshingwe River. The outline of the “megabreccia” approximates to the river bed and finer-grained sulphidic tuffs occur along the regional strike to the north and south. However, detailed mapping has not been done. The clasts in the breccia of finer-grained, grey tuffaceous rocks (not unlike the surrounding tuffs) and larger fragments of tonalite which are lithologically and isotopically very similar to the Chingezi tonalite which intrudes the Hokonui Formation to the east.

The matrix to these clasts is very pale green to cream coloured and fine-grained and appears to be a comminuted product of the clast lithologies. The age of the Chingezi tonalite is approximately 2.8 Ga

STOP 7: AGGLOMERATES, HOKONUI FORMATION

Location:

Immediately south of the Mtshingwe River Bridge on the Zvishavane-Bulawayo Road there is a road which follows the south bank of the river for about 2km before it reaches the old Mberengwa Road. Some 700m along the old road from the river is a cattle grid. A path to the east leads to the Dohwe river, an easterly trending section of which has exposed various pyroclastic flows.

Purpose:

To view the dominant lithology of the Hokonui Formation.

Description:

Narrow, fine-grained pyroclastic layers show graded bedding and flame structures.

These give way to a thick sequence of agglomerates with the dominant clasts having a similar composition to the matrix. In thin section the clasts consist of albite phenocrysts set in a dirty saussuritic groundmass containing feldspar microlites and minute quartz grains. The clast margins are very fine-grained and almost opaque except for random feldspar microlites.

The matrix to the clasts consists of cryptocrystalline volcanic fragments, blebs of chlorite, coarse clinozoisite and some anhedral feldspar megacrysts. A single ironstone clast was noted from these exposures.

STOP 8: HALL’S FLOW Contributed by Steve Scholey

Locality:

The section detailed in this contribution is located in a steep-sided ravine on the west bank of the Ngezi River, 3.25km south-south-east of the high-level bridge on the main road between Zvishavane and Filabusi. Hall’s section is best approached from the main Zvishavane to Filabusi road. Permission can be obtained from Mr P Hall (no relation), east of the high-level bridge across the Ngezi. From the gate 300m west of the bridge, follow tracks to a sharp right turn at grid reference 059421 (a disused track continues straight on). On foot, take a small game trail east to a larger stream and follow this north, crossing a fence, then east to a bend with a minor tributary entering from the south-west. This is the base of the section. Note that some agility is required to examine the key central part of the section; alternative access to the top is along the river bank from the north.

Additional weathered exposure (which better reveals some textures) occurs on kopjies to either side. Part of the 100m long section originally described by Hall (1983) as comprising a peridotite sill and several thin, spinifex-textured flows were recognised by SPS, following field investigations carried out in 1987 and 1988, as zones within a single, 70-75m thick composite unit.

Purpose:

An unusual zonation including peridotitic cumulates, both olivine and pyroxene spinifex textures, dolerite and hybridised microgabbro, which occur within a 70-75m thick, composite layered unit. Its development is regarded as a result of continuous/repeated through-flow of olivine-phyric komatiitic lavas prior to mixing with a final influx of basaltic liquid. The occurrence of orthopyroxene in

uncontaminated B_2 zone cumulates confirms its involvement, implied by Nisbet et al. (1977), in the petrogenesis of the Ngezi Group volcanics.

Geological Setting:

The Reliance Formation, about 1200m thick in this area, comprises komatiites, high-magnesian basalts and basalts with a Pb-Pb age of about 2690 Ma (Chauvel et al., 1983) at the base of a 5 – 7km thick, predominantly mafic volcanic sequence within the Ngezi (Upper Bulawayan) Group. This rests unconformably both on older supracrustal rocks within the synclinally-deformed Belingwe Greenstone Belt and the surrounding tonalitic crust (e.g. Bickle et al., 1975). Mapping by Martin (1978) places Hall's Unit at a stratigraphic height of 600 – 700m in the western outcrop of the Reliance Formation. The south to south-south-easterly strike and steep easterly dip are consistent with this location.

Pillows forming the footwall of Hall's Unit and overlying thin flows are similar to high-magnesian basalt units exposed in the Ngezi near the N.A. Mine, 4km to the north-north-west . These can be correlated (S.P. Scholey, unpublished data) with the Reliance Formation Type Section (e.g. Nisbet et al., 1977; Martin, 1978) on the eastern limb of the greenstone belt. Hall's Unit and a 200m thick layered ultramafic sill which forms the kopjies on the western side of the access track may correlate with similar units at the type locality.

Nomenclature:

The complexity of zoning within Hall's Unit has necessitated some adaptations to the conventional textural nomenclature, as follows. $A_{2\text{-}3}$ is used for small-scale alternations of random and "string-beef" pyroxene spinifex textures. Spinifex-textured zones below A_3 (conventionally platey or "string-beef") are termed A^4. Bracketed suffixes (Hy) and (Ol) are used to distinguish between repeated zones that are uniquely olivine-phyric and hybridised respectively. The upper cumulate zone is termed B_2'.

Field Appearance and Petrography:

Footwall pillows

High-magnesian basalt pillows and lobes (<1.5m thick) occur in partially boulder-covered stream-bed exposure at the base of the section. Glassy margins, spherulitic textures, quartz-filled lava tubes and vesicles, and quartz veins may be visible in the brown-weathering, pale grey-green, aphanitic rocks.

Basal chill

Massive, rubbly weathering exposure 3.5 – 4.5m below the base of the B_2 zone appears similar to the pillows, but is considered to be the basal chilled margin of Hall's Unit. Olivine comprises about 10% of the rock. Euhedral and some hopper microphenocrysts occur in clusters up to a few millimetres across. Blades up to 2mm long, some of which are an extension to the dome faces of these, are randomly oriented within a matrix of devitrified glass with spherulitic-textured, microlitic needles of clinopyroxene.

B_2 peridotitic cumulate zone

Large columnar cooling joints, decreasing in diameter near the top and base, and "elephant-hide" surface weathering, formed by thin chrysotile seams, characterise a 40m thick peridotitic zone. Generally sub-millimetric, granular and some polyhedral olivines are visible on dark grey to black unweathered surfaces. Textures are predominantly mesocumulate (~80% olivine) but orthocumulate near the base. Unaltered cores near the base are about Fo_{88} in composition. The intercumulus quench comprises serpentine and chlorite after olivine and glass with microlitic sprays and columns (<1mm long, 5-10%) of clinopyroxene. Similar columns of orthopyroxene, with near-rectangular cleavages and straight extinction occur (<2%) in a sample from 8m below the top of the zone. Chromite euhedra mantled by magnetite occur in clusters throughout.

Transitional and B_1 zones

A less melanocratic colour and the absence of columns and elephant-hide weathering mark thin B_1 and overlying A_4(Ol) zones. Textural changes are best seen in weathered outcrop on the kopjie to the north. Elongate hopper and chain olivine phenocrysts (<1.5mm diameter) gradually replace granular

habits towards the top of the B_2 zone, and in the B_1 zone become aligned sub-parallel to strike. The abundances of quench and columnar clinopyroxene each increase to about 20%. Pyroxene is unaltered but olivine is almost completely serpentinised.

A_4(Ol) porphyritic spinifex-textured zone

A 2m thick, unusually-textured zone, not known to be duplicated within the Reliance Formation, contains complex hopper olivine megacrysts up to several centimetres in size. These are apparently crystal-supported and may have accumulated from higher in the unit. The quenched matrix (~50%) contains blocky, skeletal acicular microphenocrysts of clinopyroxene, commonly in variolitic fans. Their maximum size apparently decreases upwards. Analytical data show that ferro-augitic and salitic compositions in some cases mantle magnesian (pigeonite or diopside) cores.

B_2' peridotitic cumulate zone

Orthocumulate-textured peridotites resting on the A_4(Ol) zone with a sharp, irregular but probably not erosive contact show an upward increase in olivine grain size, to about 3mm, in the 1.6m exposed. Total thickness cannot exceed about 7m. The characteristic columns have a smaller diameter than in the lower B_2 zone.

Dolerite and microgabbro

In the stream-bed above an exposure gap is about 2m of massive, pale grey, aphanitic dolerite. Stubby clinopyroxene microphenocrysts (<60%) are intergrown with plagioclase laths displaying a weak trachytic fabric and chlorite after glass. These pass upwards into coarser-grained microgabbro, with both laths and phenocrysts of plagioclase (~50%) and subophitically enclosed prismatic pyroxenes (~30%). Accessories in both these and the overlying hybridised zones include disseminated pyrite and rutile.

A_4(Hy) hybrid random spinifex-textured zone

Randomly oriented, skeletal clinopyroxene needles, 1 – 2mm in diameter and with generally upwards-increasing maximum length, from about 4 to 100mm, characterise this 4 – 4.5m thick zone. The pale green matrix is unusual for this type of texture in that plagioclase phenocrysts and laths predominate, intergrown with acicular to blocky pyroxenes (<2mm long) and altered glass.

A_3(Hy) hybrid and A_3(Ol) olivine spinifex-textured zones

An obvious transition from random to generally conical and sub-parallel crystal orientations, roughly perpendicular to the unit margins, is more subtly accompanied by the reappearance of olivine. Sub-parallel plates (<220mm x <40 x <1mm) and some elongate hopper crystals (<5-10%, altered to an aggregate of serpentine-chlorite) occur with sheaves of acicular, in some cases laterally-linked, clinopyroxenes up to several centimetres long (40-50%). The groundmass is mineralogically similar to, but much finer grained than, that in the A_4(Hy) zone.

The (dry) waterfall marks a thin (~0.3m), non-hybridised platey olivine spinifex-textured zone, with the reddish-brown colour typical of dunites. Plagioclase is absent. Olivine (~25%) is the only skeletal phenocryst phase in a quenched matrix containing chain augite.

$A_{2\text{-}3}$ random/"string-beef" pyroxene spinifex-textured zone

Zones of randomly-orientated skeletal, acicular pyroxenes up to a few centimetres long alternate with "string-beef"-textured lenses in which laterally-linked blocky and chain types occur in domains up to several centimetres across. Acicular and plumose habits occur in the quenched matrix to both textural types.

A_1 upper chilled margin

A decrease in the maximum length of acicular clinopyroxenes is apparent in the upper 2 – 3m of rubbly, grey-green exposure. A sample thought to be from close to the unexposed top of the unit contains clusters of polyhedral, hopper and bladed olivine microphenocrysts (~40%), altered to tremolite-serpentine-chlorite, in a quenched matrix comprising amphibolitised chain, composite branching and spherulitic clinopyroxenes in devitrified and patchily chloritised glass.

Chemistry:

The maximum MgO content of the Komatiitic liquids is about 21%, but the abundant olivine microphenocrysts in this sample (R3-78) may not all be post-eruptive. The most significant point to note is the marked influence of the basaltic liquid, which has caused a general decrease in abundance of compatible elements and increase in incompatible elements. The occurrences of sodic and calcic plagioclase, rutile and apatite within the dolerite-microgabbro and hybridised zones are apparent from abundances of Al_2O_3, CaO and Na_2O, TiO_2 and P_2O_5.

Petrogenesis:

Repeated/continuous through-flow of komatiitic liquids

Both Hall's Unit and thick differentiated komatiitic flows at the Type Section contain two features, cyclic A_{2-3} pyroxene spinifex-textured zones and repeated B_2 cumulate zones, regarded as a result of repeated influxes of lava with MgO content greater than about 15% (apparently the minimum required to form olivine cumulates). Although the occurrence of repetition is generally obvious in A_{2-3} zones, it is not in cumulates. This is possibly because spinifex growth both responded rapidly to and recorded any fluctuations in liquid composition which failed to affect olivine size or habit in an easily detectable manner. A probable exception to this is the upper, B_2' zone in this unit, which is considered to have accumulated from a late influx of lava which post-dated settling of chain and hopper pheno- and mega-crysts to form the B_1 and A_4(Ol) zones.

Influx of basaltic liquid

The thin, concordant unit of dolerite-microgabbro might be regarded as a later intrusive feature, but the unusual occurrence of plagioclase and rutile throughout the overlying A_3(Hy) and A_4(Hy) pyroxene spinifex-textured zones constitutes strong evidence for mixing of komatiitic host and injected basaltic liquids. These minerals are known elsewhere within the Reliance Formation only in basaltic compositions. Textural relationships suggest that growth of the thin A_3(Ol) zone commenced only relatively shortly before the basaltic influx and was interrupted by it. The platey olivine crystals occurring within the A_4(Hy) zone are considered to have broken off the spinifex crystallisation front. They do not appear to have been resorbed and formation of a B_1-textured zone would have ensued had settling not been suspended (such a zone may exist within the exposure gap about the B_2 cumulates). Crystallisation of clinopyroxene is considered to have continued after mixing (although it may have changed in composition) as it comprised a liquidus phase of both magmas.

Orthopyroxene

Nisbet et al. (1977) calculated from chemical data that orthopyroxene was involved in the petrogenesis of the Reliance Formation volcanics. This is confirmed by its occurrence within the B_1 zone of Hall's Unit.

Summary:

A number of conclusions can be drawn from current data regarding this section. Hall's Unit is a 70 – 75m thick composite unit incorporating an unusual variety and sequence of textural zones. These record continuous/repeated through-flow of olivine-phyric komatiitic liquids with an MgO content greater than about 15% prior to mixing with a final influx of basaltic liquid which decreased the temperature of the system to below the solidus. Of more general significance, involvement of orthopyroxene in the petrogenesis of the Reliance Formation is confirmed.

STOP 9: MANJERI FORMATION WESTERN EXPOSURE

Location:

The outcrop is on the Mtshingwe River some 550m upstream from the Ngezi River confluence. Access is from the Hall's flow road travelling in a SSE direction for another 6km.

Purpose:

To view the western Manjeri Formation and the differences between this outcrop and its provenance compared to the eastern succession (Stop 1).

Description:
In the bend of the Mtshingwe River, one kilometre upstream from its confluence with the Ngezi River is an exposure of the Manjeri Formation, 16 metres thick, which has been designated as a Reference Type Section for the western Manjeri Formation (Plate I). The exposure consists essentially of quartz-wackes with minor intercalated conglomerates and very minor argillites. Lacking from this exposure are ironstones and limestones which have been noted elsewhere. Despite these omissions, the exposure constitutes the only continuous succession located within the western Manjeri Formation and includes the unconformable contact between the Manjeri and underlying Hokonui formations.

The basal five metres of the exposure consists of fine arenaceous rocks with three conglomerate horizons up to 500 mm thick. The arenaceous rocks are grey-green, fine grained and contain some minute quartz grains only visible under the hand lens. The conglomerate horizons which may degenerate along strike into pebbly arenaceous rocks have poorly defined contacts. The pebbles, generally less than 50 mm across, are well rounded but of irregular shape. In the lowermost conglomerate the pebbles consist mainly of carbonated greenstone and felsic rocks whereas chert and jaspilite are the prominent types in the two upper bands. Most of the overlying beds consist of fine- to medium-grained wackes with very minor argillaceous horizons. These rocks are generally grey-green and massive although some bedding, and a very weak schistosity, is developed in places. A single lighter coloured quartz-rich band near the top of the succession exhibits pronounced herring-bone cross bedding. The sedimentary horizons dip in an easterly direction at 65 to 15 degrees whereas the underlying bedded tuffs of the Hokonui Formation dip at 80 to 90 degrees in the same direction. This angular discordance between the two formations is also shown by the gently curved nature of the Manjeri beds lying upon the linear horizons of the Hokonui Formation, In thin section, a rock from the lowermost conglomerate 22739 shows a confusion of clasts and matrix. One recognizable pebble is of a carbonated feldspar porphyry but others consists of sericite. There is an abundance of mainly angular but some rounded quartz grains up to 0,5 mm in size. Of the feldspar megacrysts present, some are undoubtedly phenocrysts within poorly defined pebbles, but others appear to be discrete detrital grains. The matrix probably consists essentially of chlorite but intergrown with other irresolvable minerals. A calcareous quartz-wacke 22740 consists of randomly scattered, angular, quartz grains up to 0,5 mm in size, with some possibly detrital carbonate mineral, in a very fine-grained carbonated matrix of practically irresolvable quartz and chlorite. Disseminated blebs of a dusty opaque mineral complete the mineralogy. Both rocks reflect the underlying lithology of the frequently carbonated, essentially volcanic Hokonui Formation.

STOP 10: RELIANCE FORMATION KOMATIITIC BASALT FLOWS AND TUFFS N.A. MINE EXPOSURE

Location:

The outcrop is on the Mtshingwe River some 1km upstream from the bridge carrying the Zvishavane – Bulawayo road.

Purpose:

To view tuffaceous beds of komatiitic basalt composition within a succession of flows.

Description:

The Ngezi River Reliance Formation exposures show a succession of spinifex textured massive and pillowed komatiitic basalt flows and tuffs.

Tuff exposures are not common with one other outcrop, also in the Ngezi River bed, some 25km downstream of the NA Mine outcrops but at both localities similar lithologies may be seen. The tuff outcrops are water worn and pale green to green in colour. They are fine to very fine grained and exhibit a variety of sedimentary features including current bedding, graded bedding and flame structures. Some bands within the tuffs contain small, rounded blebs of very fine-grained material (up to 5 mm diameter), in a fine-grained matrix and some show a vague concentric zoning. As they are consistently well rounded and constant in size, these blebs are not considered to be ordinary volcanic clasts but accretionary lapilli.

The spinifex textured flows show the cumulate olivine base followed by aligned and random clinopyroxene spinifex and these are very similar to those of the Reliance Type Section, although somewhat thinner.

STOP 11 SHABANI GNEISS RUNDE RIVER

Location:

North on the Grand View Road which leaves the Zvishavane-Mashava Road some 2.5km east of the Runde Bridge to the old strip road and then 300m west to the old bridge. Best exposures are north of the bridge and extend to the Morton Hall weir.

Purpose:

Typical banded gneisses which form the oldest rocks in the Zvishavane area and the basement to the greenstones.

Description:

The banded gneisses comprise alternating layers of an inequigranular intergrowth of quartz-plagioclase with minor untwinned microcline and accessory apatite, zircon and epidote, with a melanosome of finer grained biotite, partly altered to chlorite. The plagioclase is albite or oligoclase, showing mild sericitisation. The bands have a range of widths up to 200mm and show evidence of extreme ductility during several periods of deformation. The banding trends north-south and dips are steep. Pegmatites and felsic dykes of various ages are common, lying along the foliation or transgressing it.

The Shabani gneiss is exposed over a north-south trending area and has equivalents in the Mashava area to the east. At Mashava, greenstone remnants are more common and these are presumed to be infolded relics of the 3.5 Ga Sebakwian supracrustal event.

Age determinations on these rocks from the Zvishavane area are given in Table 2 of the overview on the CD. The gneiss includes a wide variety of lithologies from the meso-scale banded types seen in the Runde River to mega banding on a 10-20m scale in underground development at Shabanie Mine and more homogeneous foliated leucotonalite beneath the Manjeri Type Section.

STOP 12 BOUGAI PLATINUM - SHURUGWI

A detailed description of Bougai is found on the conference CD

STOP 13 SHURUGWE PEAK VIEW

Overview of the Great Dyke and Shurugwi Greenstone Belt.

RETURN TO HARARE

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