REPORT
ON
THE COOPERATIVE MINERAL EXPLORATION
IN
THE KADOMA AREA
REPUBLIC OF ZIMBABWE

PHASE Ⅱ

MARCH 1988

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

17684

PREFACE

In response to the request of the Government of the Republic of Zimbabwe, the Japanese Government decided to conduct a Mineral Exploration in the Kadoma Area Project and entrusted the survey to the Japan International Cooperation Agency(JICA) and the Metal Mining Agency of Japan(MMAJ).

The JICA and MMAJ sent to the Republic of Zimbabwe a survey team headed by Mr.Tetsuo Hatasaki from 3 July to 17 August, 1987.

The team exchanged views with the officials concerned from the Government of the Republic of Zimbabwe and conducted a field survey in the Kadoma area. After the team returned to Japan further studies were done and the present report was prepared.

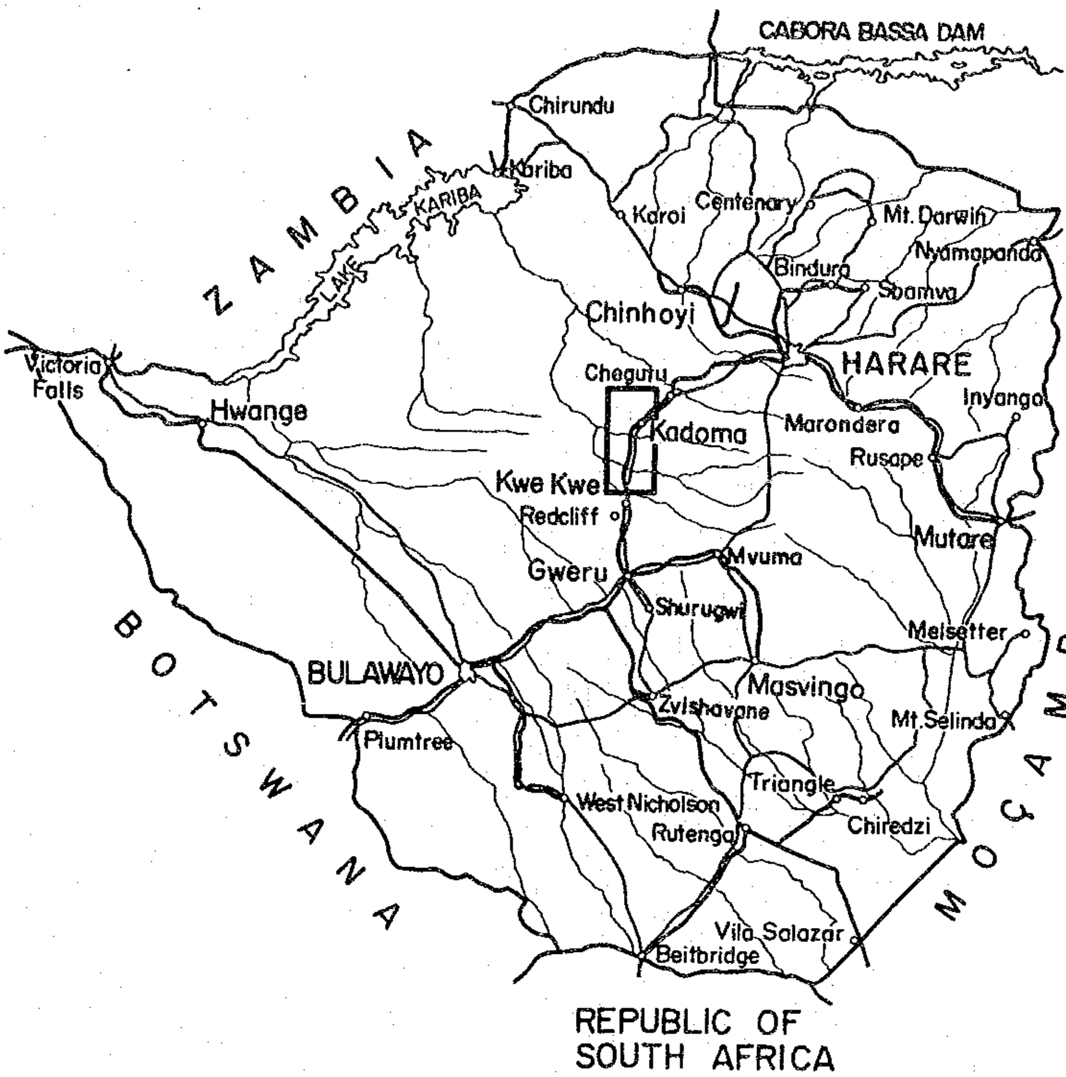
We hope that this report will serve towards the development of the Project and contribute to the furtherance of friendly relations between our two countries.

We wish to express our deepest appreciation to the officials concerned of the Government of the Republic of Zimbabwe for their close cooperation extended to the team.

January, 1988

Kensuke Yanagiya
President
Japan International Cooperation Agency

Junichiro Sato
President
Metal Mining Agency of Japan



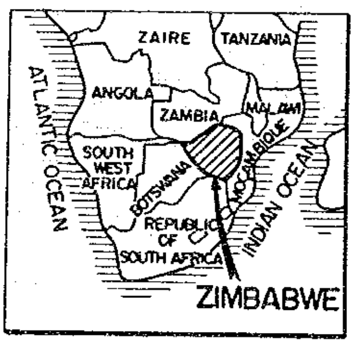


Fig.I-1-1 Location Map of the Kadoma Area,Zimbabwe

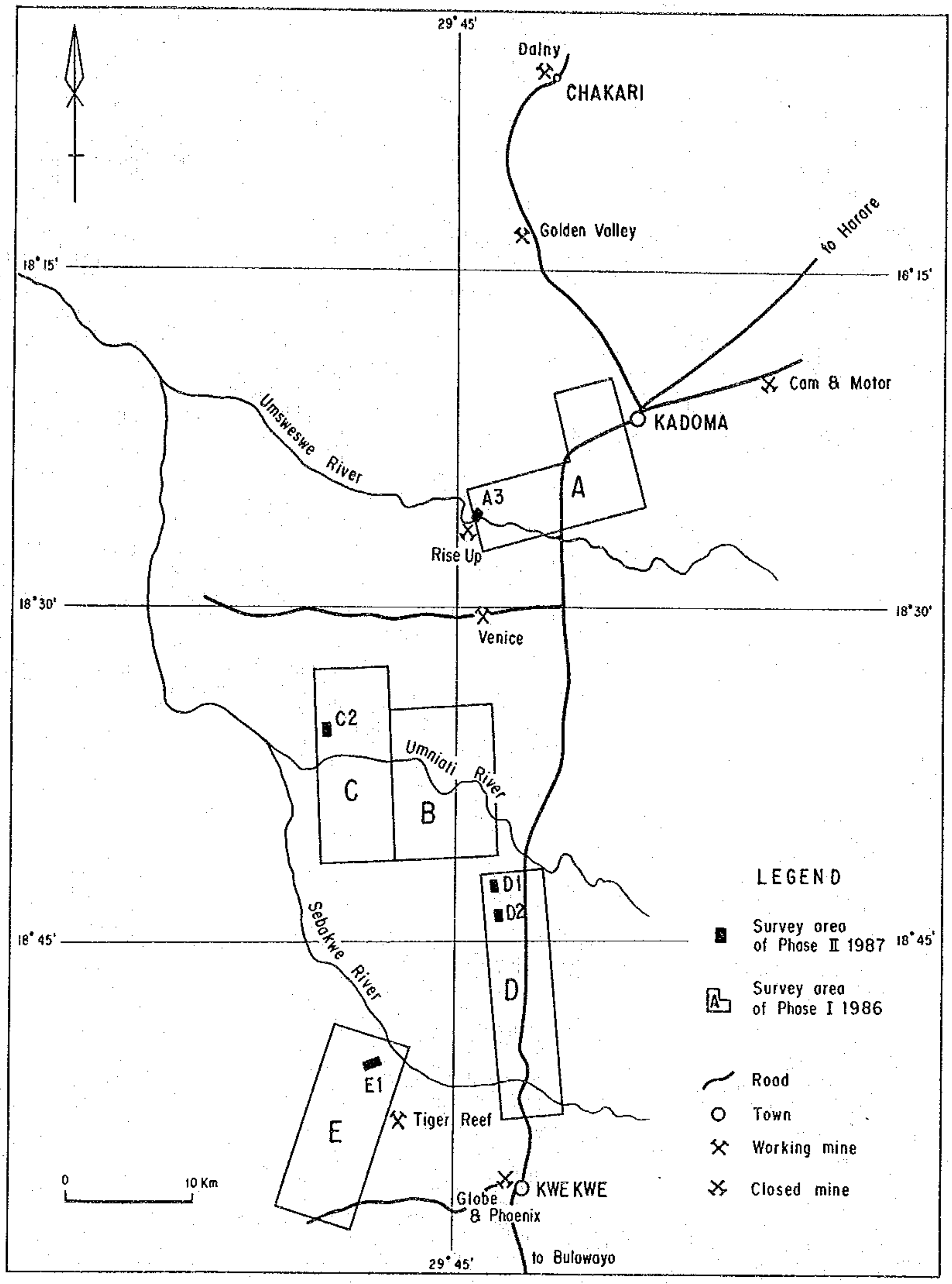


Fig.I-1-2 Location Map of the Survey Areas

SUMMARY

Summary

The Phase II survey of the Kadoma area was conducted with the aim of delineating more precisely the probable ore-bearing areas through detailed geological mapping and geochemical exploration of the soil in the survey area. The work began with the selection of five small promising areas based upon the results of the geological and geochemical survey of Phase I 1986. The field survey of the areas by two geologists lasted 46 days from 3 July to 17 August, 1987.

A total of 2095 soil samples were collected. Rock and ore samples were sent to Japan for laboratory tests such as microscopic and X-ray diffractometric analysis. Indicator elements used in the geochemical survey were Au, Ag and As for four of the areas and Au, Ag, Pt, Cu, Ni, Co and Cr for the fifth area. The geochemical analyses allowed us to home in on some promising anomaly zones, which coincide with geological environments favourable to mineral deposits within the areas.

In Area A3, a strong Au-anomaly zone showing distinct zonation, apparently attributable to auriferous quartz veins which accomapany a dyke swarm. The high intensity of the anomalies, as much as 8 to 21 times the mean value, and their location on the geostructural extension support the high evaluation.

Area E1 encloses an Au-anomaly zone within felsic terrain, which is accompanied by intense argillization, and correspondent As anomalies. Some anomaly zones yeild Au values as high as 3 g/t Au, suggesting some gold particulates.

Sulphide mineralisation of quartz veins in the vicinity of the Au-anomaly zones gives Area C2 a good ore-bearing potential.

The two other areas are ranked low comapared to the above-mentioned areas because of the weakness of the geochemical anomaly and other unfavorable characteristics. Au-anomaly zones of the survey areas are comparable to or more favourable than of the known mineral deposits of ore-bearing areas from the viewpoint of intensity and size. The evaluation may suggest that Areas A3, E1 and C2 in particular merit further exploration.

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PART I OVERVIEW

CHAPTER 1 INTRODUCTION

1-1. Conditions of the Survey

The Cooperative Mineral Exploration in the Shamva area, Republic of Zimbabwe was completed in 1985 and the Japanese government dispatched a mission for preliminary study and contract negotiations of at the request of the Zimbabwean government, to conduct new project. The Kadoma area has been selected for the second mineral exploration based upon Scope of Work signed 2 June, 1986.

The five areas subject to geological and geochemical exploration were selected out of the vast area of interest based upon the study of technical documents, exploration history and the proposal of the Geological Survey Department. The purpose of the Phase II survey was to determine the mineralisation of the five small areas, which had been localised as the conclusion of the Phase I exploration, through more detailed geological mapping and geochemical exploration of soil.

1-2. Conclusions and Recommendations of Phase I

1-2-1. Conclusions of Phase I

The results of the Phase I programme indicate that the areas appropriately selected for the survey have high potentials for certain mineral resources, and that the areas merit further exploration. Fig.I-1-2 shows the entire area of the Phase I survey.

Area A is situated in a favourable geological environment; the surrounding area of the Whitewaters Tonalite Body which is accomapanied by gold and tungusten minerals in the north. In the geochemical survey, large-scale W-anomaly zones in the northeastern A-1 Block and in the northwestern and southwestern A2 Blocks, are hopeful targets for further exploration activity, especially at points which are accompanied by Au-anomalies.

In Area B, strong small-scale Au-and As-anomalies are repeated in a spot in the northern area. This is the most suitable target for further study.

Area C contains several small-scale quartz porphyry stocks. In the Phase I survey, a large number of quartz veins, trenches and old workings in the northeastern corner of the area lead to a favourable appraisal of mineral potential. In the geochemical survey, strong small-scale Au-anomaly zones accompanying Zn anomalies appear in the northwest and northeast of the area and are worth further exploration.

Area D is mainly underlain by the Kwekwe Ultramafic Complex, which is a favourable host rock for nickel sulphide deposits, because the well known Hunters Road nickel deposit is on the southern extension of the Complex. In the Rhodesdale Gneiss, a large number of quartz veins are observed in the eastern edge of the area, suggesting potential gold and silica resources. In the geochemical survey, a strong small-scale Au-anomaly zone in the northwest which is accompanied by Ni and Cr anomalies. This, in combination with a favourable geological environment;the edge of the Ultramafic Complex, yields a promissing target for further exploration. A small Au-anomaly zone in the central area is also highly evaluated.

Area E encompasses some known gold occurrences. In the Phase I survey, a large number of mineral occurrences and old workings were found,especially in the north, and a high potential for gold is recognized. The geochemical survey delineates a significant large-scale Au-anomaly zone in the northeast part of the area. This is the most prominent feature in the programme, and is therefore one of the best targets for further exploration.

1-2-2. Recommendation

Based upon the conclusions mentioned previously, the following surveys are recommended for the next phase programme.

1.Drilling in the most favourable anomaly zones.

2.Detailed geochemical surveys of some other anomaly zones.

1-3. Outline of Phase II survey

1-3-1. Survey area

Fig.I-1-1 and Fig.I-1-2 show the survey area including the five small target areas of the Phase II survey. The survey area is located between 100 and 230 kilometres southwest of the capital city; Harare, which is connected with the second major city of Zimbabwe;Bulawayo, via the main highway and railway running through the survey area. Two major industrial and farming centres, Kadoma and Kwekwe, are located in the north and south of the general project area respectively. It is about one and three quarters hour drive for the 140 kilometres from Harare to Kadoma on a good highway, and a one hour drive of 80 kilometres from Kadoma to Kwekwe. A well-developed local road network connects farm land and local villages in the area.

1-3-2. Purpose of the Survey

The purpose of Phase II survey was to conduct a detailed geological and soil geochemical surveys in the five areas that were selected on the basis of Phase I exploration and to evaluate mineral potential of the areas from the viewpoint of economic geology. A further purpose was preparation for the Phase III programme.

1-3-3. Methods of the Survey

Methods used and specifications of the survey are as follows.

<u>Geological Survey</u>

Area covered	2.36 km²

<u>Geochemical Survey</u>

Area covered	2.36 km²
Soil sampling	
Survey line interval	50 m
Sampling interval	25 m
Sampling depth	10~20 cm, B layer
Preparation of soil sample	-80 mesh
Indicator elements	
Au, Ag, As	1806 for Area A3, C2, D2, E1
Au, Ag, Pt, Cu, Ni, Co, Cr	289 for Area D1

Laboratory Tests and Analyses

Rock thin sections	20
Polished sections of ore	20
X-ray diffractometric analyses	20

1-3-4. Organization of the survey team

The members involved in the planning, managing and field survey are as follows.

Planning and Negotiation

Japanese member		Zimbabwean member	
Toshihiko HAYASHI	Metal Mining Agency of Japan(MMAJ)	E.R.Morrison C.B.Anderson	Geological Survey Department do.

Field Survey

Japanese member		Zimbabwean member	
Tetsuo HATASAKI Makoto TAKEDA	Dowa Engineering Co.Ltd. do.	S.Simango F.Maguchu	Geological Survey Department do.

1-3-5. Period of the survey

*Survey in Zimbabwe : 46 days; 3 July～17 August, 1987
*Analysis and Report
Preparation of the PhaseII: 18 August, 1987～29 January, 1988

CHAPTER 2 GEOGRAPHY OF THE SURVEY AREA

2-1. Topograpy and Drainage System

The survey area is located on the Southern African Plateau at an altitude of 1,000 to 1,300 metres above sea level. Topography of the area is mostly quite flat, but there are some hills (approximately 100 metres high) in the area south of Kwekwe. The Umsweswe river in the north and the Sebakwe in the south of the area flow from east to west. The two join with the Uminiati river flowing northwestward and this in turn flows into the Zambezi river.

2-2. Climate and Vegetation

Despite the latitude ranging from 18° 00′ to 19° 00′ south,the climate of the area is not tropical due to the high altitude. The year is clearly divided into two seasons a dry season from April to October and a wet season between November and March. Annual precipitation is usually 700 to 900 millimetres. The temperature is a maximum of 30° C and a minimum of 16° C in summer, and a maximum of 21° C and a minimum of 7° C in winter. October is the hottest month of the year and then the temperature decreases,due to cloud cover.

The area is sparsely vegetated, generally being a few shrubs, ocassionally broken by thickets of thorn trees.

Chapter 3 General Geology

Fig.I-3-1 illustrates the geologic column of the Kadoma Area. The area consists of a granitic-gneissic terrain, greenstones and intrusive bodies of Archean age.

The Rhodesdale Granite-Gneiss Complex is exposed in the eastern area as the western edge of the Complex. Locally, highly metamorphosed rocks of the Sebakwian Group, the oldest group in the area, are enclosed in the body.

The Greenstone belt consists of the Bulawayan and Shamvaian groups. The Bulawayan Group,which is distributed across large parts of the area, is divided into two sub-groups; the Lower Greenstones and the Upper Greenstones. Both sub-groups mainly consist of mafic volcanic rocks and pyroclastic rocks, accompanied by felsic volcanic rocks and pyroclastic rocks, banded ironstone, and sedimentary rocks. The Shamvaian Group is distributed in a belt from the northeast to the southwest in the area, and consists of shallow marine sediments such as sandstone and conglomerate.

With regard to intrusive bodies, the Whitewaters Tonalite Body is located in the northern area, and the Sesombi Tonalite Body in the western area. K/Ar radiometric age determinations of the two bodies were conducted in the Phase I survey. The results show that the age of the Whitewaters is 1,829±91 Ma, and that of the Sesombi is 2,139±112 Ma. The two bodies are economically important due to their association with gold and tungsten mineralisation. Other small scale quartz porphyry and dolerite dykes are scattered across the area. In the south-central area, the Kwekwe Ultramafic Complex Body is distributed in the zone adjacent to the Rhodesdale Complex Body. The geological structure is substantially controled by the primary folding structure whose axes trend NE-SW. Fracture systems with a clear trend, which has formed during a series of subsequent deformations, could be host to gold mineral deposits.

The survey area is within a major gold producing district, where working mines such as Dalny, Venice, Riverlea, Tiger Reef, numerous old workings and mineral occurrences are located. They are classified into; Banded Iron Formation type, Auriferous quartz network shear zone type and stratabound disseminated

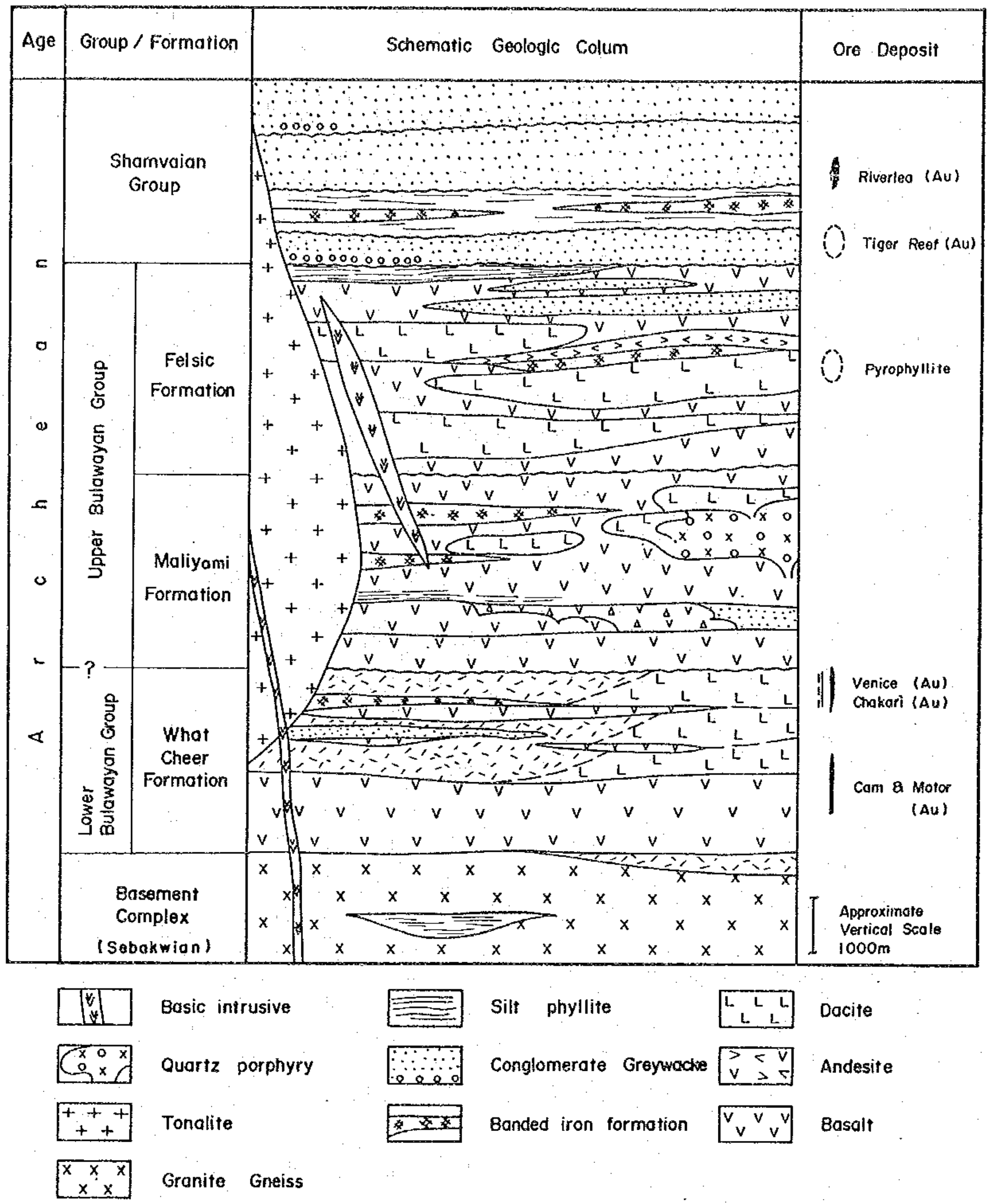


Fig.I-3-1 Schematic Geologic Columnar Section of Kadoma District deposit type by ore genesis and host rock. Dalny is the largest of the producing gold mines, with five million tons of ore extracted to the present, equivalent to 38 tons of gold. The current production rate of the mine is approximately 20,000 tons per month with an average grade of 9 g/t Au.

CHAPTER 4 COMPREHENSIVE DISCUSSION

4-1. Geological survey and Trenching

Detailed geological surveys were chiefly conducted along the baseline and survey lines of geochemical sampling,permitting us to locate old trenches and to evaluate the geochemical anomalies more precisely than in the Phase I. Due to the poverty of rock exposure, the survey gathered insufficient data as to the stratigraphic relationships between the geologic units.

Area A3 is predominantly underlain by Lower Bulawayan massive basalt intercalated with banded ironstone,which is intruded by felsic and granitic dyke rocks trending NNE～NE or NNW. General strike and dip seem to be N5° E～N15° E, 80°～90° judging from local schistosity of the mafic rocks and distribution of banded ironstone boulders. Quartz veins run NNE or NE, parallel to certain of dykes. A series of old trenches were found, possibly indicating small-scale exploration of auriferous quartz veins.

The Phase II trenching confirms the above-mentioned geological data and reveals that the quartz assayed at 1.7 g/t Au, could be a cause of the Au-and Ag-soil anomalies in the vicinity.

Area C2 is underlain by Upper Bulawayan Greenstones and dolerite dykes that trend north-south. The greenstone is commonly andesite, which trends north-south and dips almost vertically. The old trenches, which follow a swarm of quartz veins weakly mineralized with chalcopyrite and pyrite are distributed parallel to the northeast.

Area D1 consists of Upper Bulawayan in the west and Kwekwe Ultramafic Complex in the east. Banded Iron Formation (BIF for short)of the former extends with a strike of N50° W and dips 75-85° east. Old trenches are mapped in a direction of N50°W in the south.

Area D2 is on the geological extension of Area D1. In the vicinity of Rosstack mine (abandoned), the variation in the strikes and dips of the banded ironstone, from N20° W to N70° W and from 10° S to 65° S respectively, shows folding structure. Numerous old trenches 25 metres to 30 metres long, dug parallel to N45° E～N60° E in the BIF terrain, are also found aroud the mine.

Area E1 is mainly composed of Upper Bulawayan felsic lava, felsic tuff and BIF trending northeast. The felsic tuff, being cream yellow, shows distinct schistosity and has undergone pyrophyllitic alteration.

4-2. Geochemical Survey

The Phase II geochemical survey raised sampling density to about twenty times as high as in Phase I, making the survey lines and sampling intervals 50 metres and 25 metres respectively.

Indicator elements selected were Au,Ag and As for four of the areas and Au,Ag,Pt,Cu,Ni,Co and Cr for Area D1, based upon rock type and potential mineralisation. Statistical procedures for geochemical values yield the threshold and screens out anomalies from the mean value and standard deviation as used in Phase I geochemical analysis. Taking into account that the Phase II exploration was more advanced than Phase I, this time arithmatic mean values and standard deviations were used to increase the threshold value.

Statistical analysis reveals that the mean value differs between rock types; it is the highest for BIF; more than twice that of mafic lava in almost all areas.

Correlation efficients between indicator elements suggest good correlation between Ni,Cr and Co but show poor correlation between Au,Ag and As, except for one area. Au anomaly maps are mainly used for evaluation of geochemical anomalies because of poor correlation, possible primary dispersion of elements and geochemical information from the gold mineral belt of Zimbabwe.

In Area A3, the threshold value of $M+2\sigma$ for mafic lava is five and a half times the mean value and is the highest among the five areas. There are six zones in which the $M+2\sigma$ intensity varies from eight to twenty one times the mean value. The intensity of each anomaly thus indicates the high gold potential of this area. The concentration of As is low at most two times the mean value. The As anomalies are distributed around Au anomalies, particularly along the topographically lower side of the latter.

Au anomalies in Area C2 are concentrated into two zones having remarkable intensities of three to twelve times the mean values. As-anomaly zones which are coincident with the dolerite dykes, show an obvious trend.

The anomaly patterns in Areas D1 and D2 are similar to each other. Au threshold values are obvious because of the much larger area of BIF terrain in the two areas and because the intensity of the M+2σ threshold value is not as large as the individual values for Au. The anomaly zones extend in a direction parallel to the strike of the BIF.

Area D2 gives the highest Au value which may be caused by contamination from the tailings dump in the centre of the area. Nevertheless interpretation of the anomaly zone, conforming with the strike of BIF, still remains unsettled.

Three Au-anomaly zones were delineated in Area E1. One of them enclosed within felsic lava and felsic tuff terrain, corresponds with an intense pyrophyllitic alteration zone and an As-anomaly zone. An anomalous value four to twenty times the mean value should also be well noted. The other two medium-sized anomalies limited to BIF terrain, give Au values as high as 1 to 3 g/t and are suspected to contain gold particulates. The potential pf Area E1 is evaluated second only to that of Area A3.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATION FOR PHASE III EXPLORATION PROGRAMME

5-1. Conclusions

The Phase II detailed geochemical survey delineated some potential anomalies within the survey areas. Detailed geological survey and trenching confirmed this evaluation, suggesting the relationship between geochemical anomalies and the geological environment.

Area A3 takes the first priority in further exploration for favourable Au-anomaly zones.

Area E1 is also highly ranked for its potential delineating three anomaly zones, one of which it should be noted,has a correspondent As-anomaly. The two other areas are of high potential, with gold values of 1 to 3 g/t, which suggest possible gold particulates in soil.

Area C2 is believed to have good potential but further exploration neccesitates more detailed mapping of the quartz vein system.

Area D1 is ranked slightly lower than the three above-mentioned areas because of the lower magnitude of the anomalies and zonation within the BIF terrain. Metal content and low indicative ratio between indicator elements reveal that the potential for platinoid and Ni mineral deposits in the Kwekwe Ultramafic Complex is quite low.

Area D2 is difficult to evaluate properly as to mineral potential because the anomalously high Au values are apparently due to contamination by the tailings dump. But an As-anomaly zone delineated near the Au-anomaly zone suggests some Au potential remains.

5-2. Recommendation for Phase III exploration

The following exploration programme is recommended for Phase III

1. Diamond drilling as deep as one hundred metres at the Au-anomaly zones in Area A3,E1 and C2.

2. Assay of ore samples encountered by drill holes.

3. Trenching in Area C2 prior to drilling.

PART II DETAILS OF THE SURVEY

CHAPTER 1 SURVEY METHODS

1-1. Geological Survey

The survey lines for soil sampling were designed so as to cross perpendicular to the geological trend determined in the Phase I survey and were selected as geologic survey routes. The interval of the lines is 50 metres. Topographic maps at a scale of 1 to 2,500 were used.

1-2. Trenching

Trenching was conducted using JCB 70 H.P. Type 4D Excavator which typically digs trenches 1 metre wide, 20 metres long, 2 metres deep. Trench location and design were based upon the geological environment and geochemical anomalies of Phase I. Mapping of detailed geology and mineralisation at a scale of 1 to 100 and rock sampling for laboratory tests and analysis followed the trenching. The trenches were recovered after the survey was finished.

1-3. Geochemical Survey

Soil samples were collected at 25 metre intervals along the survey lines 50 metres apart from each other, which had been designed so as to cross the geochemical anomaly zones delineated in the Phase I survey. The survey areas are generally shallow-soiled and an A layer is rarely formed. Soil samples were taken from the B layer, mostly 10 to 20 centimetres deep at most, and sieved down to -20 mesh on the site. They were re-sieved to -80 mesh to prepare final samples of about 100 grammes each for geochemical analysis.

The soil color was recorded from the final soil samples using a rock color chart.

1-4. Selection of Indicator Elements

Selection of elementary indicators which have good correlation with Au and to be used in Phase II was made on the basis of the correlation obtained from the Phase I geochemical survey. In the Phase II survey, bibliographic study prior to geochemical survey indicated useful four-element combinations for each area, according to minerals accompanying gold in the known ore deposits and geologic environment.

The analysis revealed that there was a clearly positive correlation for all areas between Pb and Zn and Ni and Cr and there is a more-or-less positive correlation for felsic intrusive rock between Au and Sb, Au and As, and Sb and As. The EPMA study of ores suggested that some electrum contains more than 40 per cent Ag. The above-mentioned discussion resulted in the use of an Au,Ag and As combination for Areas A3,C2,D2 and E1, and Au-Ag-Pt-Cu-Ni-Co-Cr combination for Area D1 in the Phase II geochemical survey.

1-5. Method of Chemical Analysis

The soil samples from Phase II were dispatched to McLahalan and Lazar Pty Ltd. of South Africa for chemical analysis. The following analytical methods and detection limits were adopted.

Element	Analytical Method	Detection Limit
Au	Fire Assay and AAS*	0.05 g/t
Ag	Fire Assay and AAS	0.1 g/t
As	Hydride Generation	5 ppm
	X-ray fluorescence	10 ppm in Area D2
Pt	Fire Assay and AAS	0.1 g/t
Cu	AAS	1 ppm
Ni	do.	1 ppm
Co	do.	1 ppm
Cr	do.	10 ppm< <0.5 %

(*;Atomic Absorption Spectrometry)

Since the areas to be surveyed were those chosen as anomalies zones through the Phase I analysis, the detection limit for Au was raised from 10 ppb in Phase I to 50 ppb. McLahalan and Lazar re-analyzed the samples which gave 0.15~0.20 g/t for the first analysis commenting that gold particulate is suspected in such samples. The hydride generation method is usually used for As analysis, but some batches in Area D2 were changed to the X-ray fluoresence method because of high As concentration.

1-6. Evaluation Procedures and Fundamental Statistics

Prior to statistical analysis, the Au values smaller than the detection limit, were recalculated to half of it,and Cr values above the upper detection limit were fixed to the limit. In cases where two or three values were given by re-analysis, when one value exceeded the detection limit, the value was used without any modification,and when two or three values exceeded the limit they were recalculated to find an arithmatic mean for the sample. This procedure of values was aimed at locating the anomaly and to set higher threshold values in order to pinpoint the anomalies more precisely. For statistical calculations, analysis and illustration, The NEC personal computer PC 9801 UV and the Roland DG DXY-980 plotter were used.

Since the statistics give considerable differences in Au values for each area and rock type, histograms of geochemical values and cumulative frequency distribution diagrams are given for rock types whose number of samples exceeds seventy. The indicator elements statistically processed in this way are as follows.

Area	Indicator	Rock Type
A3	Au Ag As	Mafic Lava
C2	Au Ag As	Mafic Lava, Mafic Intrusive
D1	Au Ag Pt Cu Ni Co Cr	BIF, Ultramafic
D2	Au Ag As	Mafic Lava, BIF, Ultramafic
E1	Au Ag As	Mafic Lava, Felsic Lava, BIF

The fundamental statistics for each area, indicator elements and rock types are shown in Table II-2-1 Table II-6-1.

The Phase II analysis assigned arithmatic mean and standard deviation in place of geometric mean and standard deviation, which were used for $M+\sigma$ and $M+2\sigma$ to give threshold values in Phase I because the arithmatic mean was generally larger than the geometric one when each value deviated to any extent. This procedure was also aimed at selections of stronger anomalies. Values larger than the threshold;$M+\sigma$,$M+2\sigma$ are refered to as B-rank anomalies and A-rank anomalies, respectively. More than three or more neighbouring anomalies of B-rank are grouped into an anomaly zone, whereas two or more of A-rank are grouped into an A-rank anomaly zone. The anomaly zones thus delineated are shown in geochemical anomaly maps with the geology of each area.(Fig. Ⅱ-2-1, Ⅱ-3-1, Ⅱ-4-1, Ⅱ-5-1, Ⅱ-6-1, PL. Ⅱ-2-3～5, Ⅱ-3-2～4, Ⅱ-4-2～8, Ⅱ-5-1 3, Ⅱ-6-2～4)

CHAPTER 2 Area A3

2-1. Geology

Topograpy

Being located on the north bank of the Umniati river, recent fluvial sediment has been deposited up to approroximately 30 metres from the bank. The rocks are comaparatively well exposed about 5 metres above the water level.

Geology

Fig.II-2-1,PL.II-2-1 illustrate the geologic map. The geology consists mainly of basalt and thin Lower Bulawayan BIF and various types of intrusive rocks, including aplite, fine granitic rock, quartz porphyry dykes and dolerite.

Basalt is of fine to medium massive facies with intercalated bedded basaltic tuff, stratified amygdaloidal pillow breccia, lapilli stone and pelitic sediments.

The granitic intrusive rock is medium grained, containing phenocrysts of biotite and porphyritic plagioclase. The quartz porphyry includes a large amout of quartz phenocrysts 3-5 milimetres in diametre and has been affected by intense sericitization. Dolerite, as well as felsic dykes, are limited to southwest of the area.

Geological structure

Schistosity or bedding recognized in the basaltic tuff trends N5° E-N15° E with a steep dip, but it is not obvious if the trend is conformable to the general structure. As the area occupies a part of regional anticlinorium and synclinorium whose axes are NNW-SSE trending, the NNE trend of the schistosity vaguely reflects the geologic structure.

The fracture system which resulted in the introduction of a swarm of dykes, comprises two trends, one which is N30° E and the other which is N10-20° W. A series of old trenches, which may run along the quartz reef (veins) trends N20°E-N30° E as well.

Mineralisation

Few quartz veins are mineralised with sulphides, however, basaltic rock which has been intruded by various types of rock and quartz veins is often weakly mineralized with chalcopyrite and pyrrhotite, accompanied by silicification.

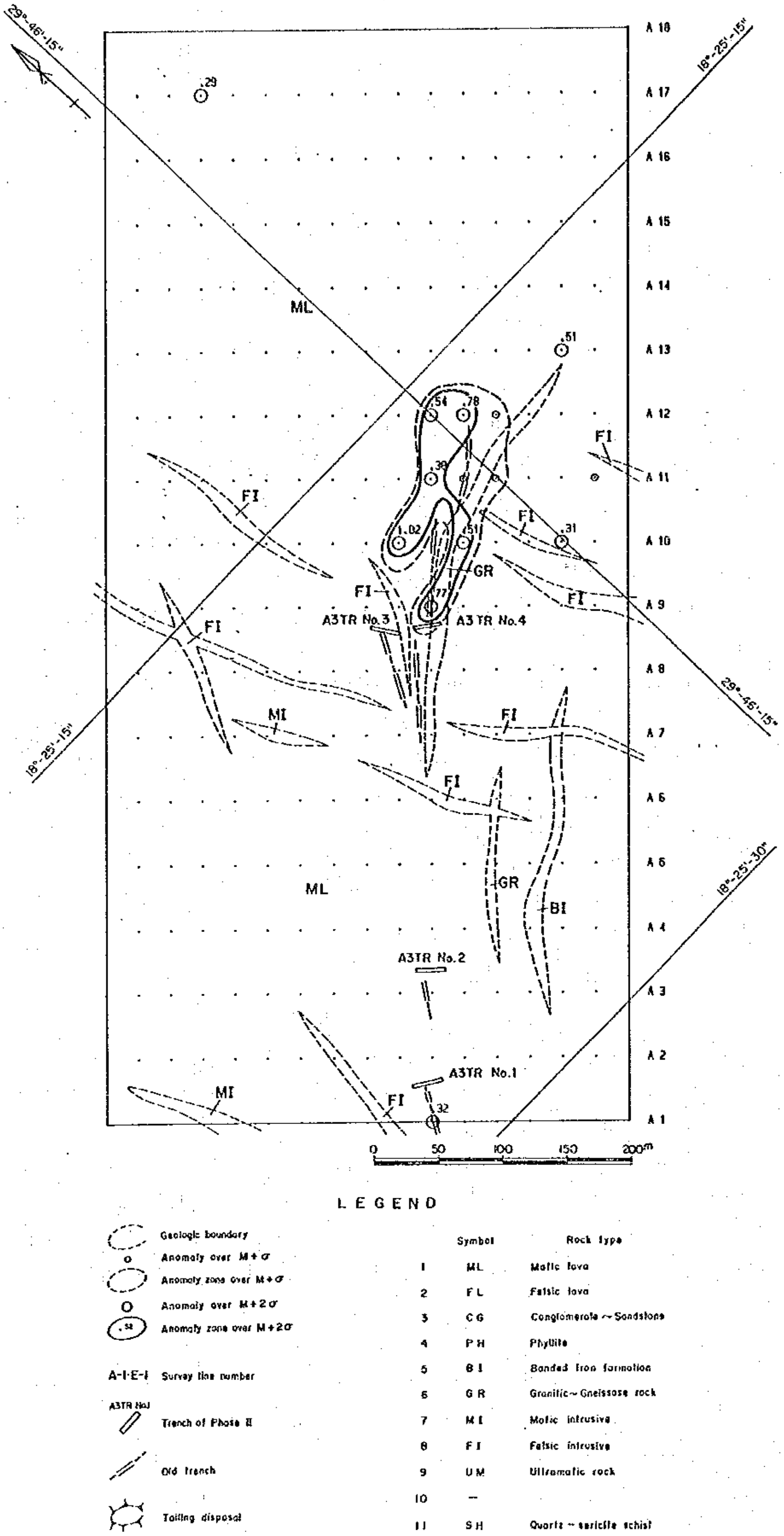


Fig.Ⅱ-2-1 Geochemical Anomaly Map Au of Area A3

2-2. Trenching

PL.II-2-2 shows a geological sketch-map combined with the results of the geochemical assays. Detailed geological surveying, which was conducted in parallel with soil sampling, revealed a series of trenches that were not recognized in the Phase I general survey. They suggest active exploration in the past, but they are almost entirely filled with earth now that leaves their true depth unknown. The volume of earth piled alongside them suggests a depth of 3 to 5 metres.

The trenching sites were selected so that they would be located near the geochemical anomalies and crosscut the geological structure. They were planned so as to avoid the periphery of the old trenches.

The heavy machine used was the JCB Type 4D excavator, manufactured by J.C.Bamford Co., in Rochester England. Although the trenches were specified as 1 metre wide, 20 metres long and 2 metres deep, bed rock was frequently shallower than 2 metres.

<u>A3 TR No.1</u>

Overburden is 0 to 1 metre thick consisting of quartz pebbles and basalt pebbles with a very small amount of reddish brown soil. Fine grained basalt is intercalated with chert and hematite layers which strike N35°E dipping 75° east. The basalt underlying the chert has a well-stratified tuffaceous facies. Some quartz veins are intermittently associated with the chert.

<u>A3 TR No.2</u>

The thickness of overburden varies from 0 to 1 metre with sometimes 10 to 20 centimetres fine soil. Apparently the overlying strata is basalt intercalated with felsic tuff containing pelagic sediment or hematite, whereas the underlying strata appear to essentially consist of sericite quartz schist which possibly originated from a felsic tuff. The structure of these strata uniformly trends N20°E~N40°E and dips east at 70~80° . No quartz veins were observed.

<u>A3 TR No.3</u>

The soil profile is the same as in the above-mentioned trenches. The geology consists of massive basalt which has been intruded by quartz porphyry. The contact between the two trends N30° E dipping 65° east, suggesting that it may be concordant with the general geologic trend. Characteristic evidence implying the quartz porphyry to be an intrusive rock is not present within the trench, however, The quartz porphyry is thought to be a dyke because in other parts of Area A3, the rocks of similar type obviously intrude the basalt. Veinlets of quartz run along the contact with the basalt.

A3 TR No.4

This trench consists of basalt and granitic rock as in Trench No.3. The granitic rock shows facies similar to that of the quartz porphyry, although they are distinguished from each other. The contact between the basalt and the intrusive rocks trends N40° E and dips 70° S, which roughly coincides with general geologic trend of the area. A quartz vein, of which assay gives 1.737 g/t Au, occurs at the contact of the granitic intrusive rock and within it.

2-3. Geochemical Survey

PL. II-2-3, II-2-5 illustrate the geochemical anomalies for each element. Table II-2-1 shows the fundamental statistics for each element for each rock type. Table II-2-2 shows correlation coefficients between element and rock type and Fig. II-2-2, II-2-3 illustrate histograms and cumulative frequency distribution diagrams of elements for rock types.

Au

The anomalous values are well concentrated in the centre of the area and form an anomaly zone which consists of 2 B-rank and 7 A-rank anomalies. The threshold value of the A-rank anomaly zones is 5.5 times as high as the mean value for mafic lava and is the highest among the areas of Phase II . Each value of the zone is 8 to 21 times as high as the mean value. The anomaly zone extends over an area of 150 metres by 50 to 100 metres and is mostly assigned to mafic lava terrain. The configuration is concordant with NE and NS trends of dyke rocks.

Ag

Ag—anomaly zones are scattered around the Au—anomaly zone without correlation. An A-rank anomaly zone consisting of 3 anomalies in the north, and B-rank anomaly zones of 6 to 13 anomalies in the west and southeast have been delineated.

As

The areal extent of the anomaly zone is larger than the two above-mentioned indicators, however, the characteristics of the shape are obscure. Being poorly coincident with Au-or Ag-anomaly zones, the irregular anomaly zone distributed in the south to southeast part of the area where the land slopes downward from around the Au anomaly zone toward the Umniati river. As-mobility or dispersion may restore the primary coincidence with the Au anomaly zone. In the south, the anomaly zone contains 4 A-rank anomalies.

2-4. Discussion

Au–As–and Ag–anomaly zones are in part located near old trenches in the south to southeast part of the area, where a swarm of dykes with NE,NS trends runs. Northeast oriented dykes accompany quartz veins parallel to it there. Trenching and a 1.7 g/t Au assay for the quartz vein may suggest substantial gold mineralisation. The anomaly zone is possibly on the extension of the geochemical anomalous and structural trend from Rise Up mine on the opposite side of the Umsweswe River.

The mineral potential of the Au–anomaly zone is highly evaluated to be the most promising.

Table II-2-1 Fundamental Statistics of Each Element for Each Rock Type, Area A3

Elem -ent	Rock Type	Number of Smp.	Min. ppm	Max. ppm	Arith. Mean ppm	Std.Dev. ppm	Geomet. Mean ppm	Std.Dev. log
Au	Whole	294	L 50	1,020	49	106	30	0.28
	ML	265	L 50	1,020	49	110	30	0.28
	FL							
	BI	3	L 50	320	123	139		0.52
	MI	2	L 50	25	25			
	FI	17	L 50	130	33	25		0.18
	GR	6	L 50	50	29	9		0.11
	UM							
Ag	Whole	294	50	1,400	271	188	205	0.35
	ML	265	50	1,400	265	192	198	0.36
	FL							
	BI	3	300	600	467	125		
	MI	2	300	300	300	0		
	FI	17	50	600	297	124	263	0.25
	GR	6	100	600	367	160	320	0.25
	UM							
As	Whole	294	6	60	25	11	23	0.18
	ML	265	6	60	24	10	22	0.18
	FL							
	BI	3	42	53	47	5		0.04
	MI	2	12	23	18	6		0.14
	FI	17	18	49	29	10	27	0.14
	GR	6	17	50	25	11	14	0.16
	UM							

Note 1. ML ; Mafic Lava FL ; Felsic Lava BI ; Banded Iron Formation
MI ; Mafic Intrusive FI ; Felsic Intrusive GR ; Granitic Rock
UM ; Ultramafic Rock
2. Grade of Au is ppb.
3. L 50 means less than detection limit (50 ppb for Au)

Table Ⅱ-2-2 Correlation Coefficient between Element Area A3

Rock Type	Au－Ag	Au－As	Ag－As
Whole	－0.01 (0.02)	0.15 (0.20)	0.05 (－0.00)
M L	－0.01 (0.02)	0.15 (0.19)	0.01 (－0.04)
F L			
B I	－0.95 (－0.97)	－0.16 (－0.12)	－0.18 (－0.13)
M I			
F I	0.56 (0.30)	0.10) (0.18)	－0.09 (0.00)
G R	－0.19 (－0.05)	－0.09 (－0.03)	0.49 (0.21)
U M			

Note * M L ; Mafic Lava F L ; Felsic Lava B I ; Banded Iron Formation
M I ; Mafic Intrusive F I ; Felsic Intrusive G R ; Granitic Rock
U M ; Ultramafic Rock ( ) ; Logarithmici Data

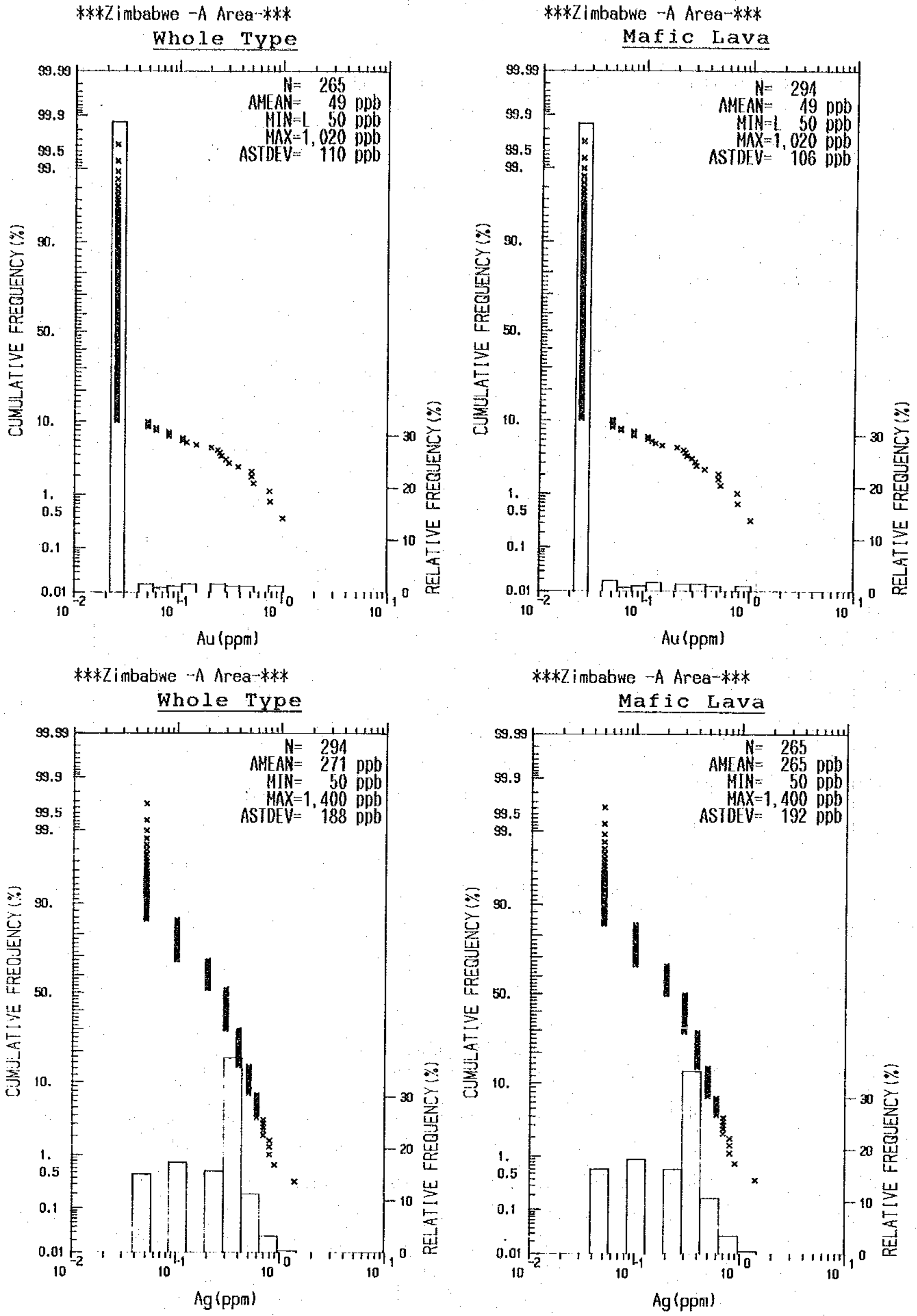
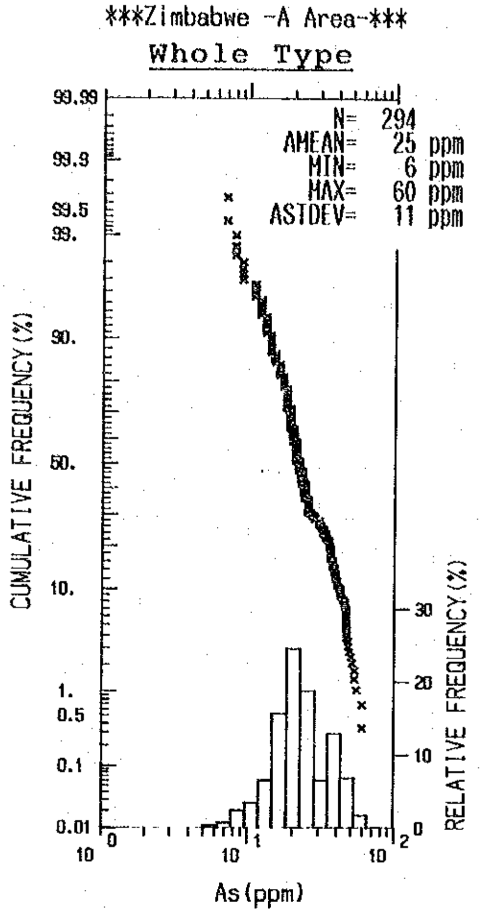


Fig.Ⅱ-2-2 Histogram and Cumulative Frequency Distribution Diagram of Au,Ag for Rock Type, Area A3



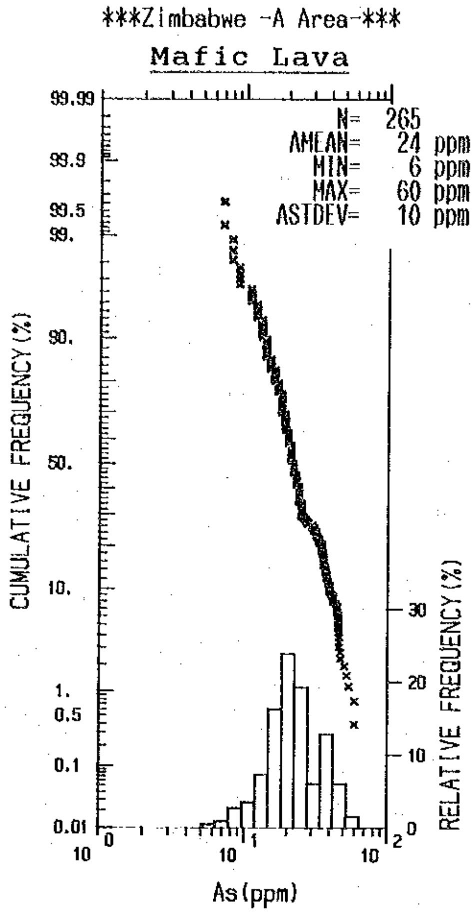


Fig.Ⅱ-2-3 Histogram and Cumulative Frequency Distribution Diagram of As for Rock Type, Area A3

CHAPTER 3 C2 AREA

3-1. Geology

Topography

The area has less relief, and is sandwiched on the east and west sides by gentle northernly oriented valleys.

Geology

Fig. II-3-1, PL. II-3-1 show the geologic map of the area. Rocks rarely crop out except for doleritic intrusive rocks. The Greenstones are basaltic to andestic, with evident pyroclastic texture. They contain felsic fragments of from 5 to 10 centimetres in diametre which show stratification. The lava is amygdal with vesicles a maximum of 1 centimetre in diametre. There are green patches which could be elongated volcanic glass. The Greenstones strike N10° E-N10° W and dip 80°~90° S. A swarm of quartz veins hosted by the dolerite trends north-south as well.

Mineralisation

Some quartz veins within the doleritic intrusive rocks in the eastern end of the area, have been mineralized, with small amounts of chalcopyrite and pyrite which have been oxidized in part to form secondary minerals.

Old trenches which trend N40° E-60° E are limited to the eastern boundary.

3-2. Trenching

PL. II-2-2 illustrates the detailed geology of the trenches. Since migration of primary geochemical anomalies is considered to be small based upon the topography, the selection of trenching sites was made on the anomaly zones from the general geochemical exploration of Phase I. The environs of the site provide few outcrops though a great deal of quartz pebbles are scattered on the surface. The excavation was done through man power because of the breakdown of the JCB excavater's engine.

C2 TR No.1

The overburden is 0-80 centimetres thick. A transitional zone, which consists of a small quantity of soil and autochthonous weathered rock, lies between the topsoil and

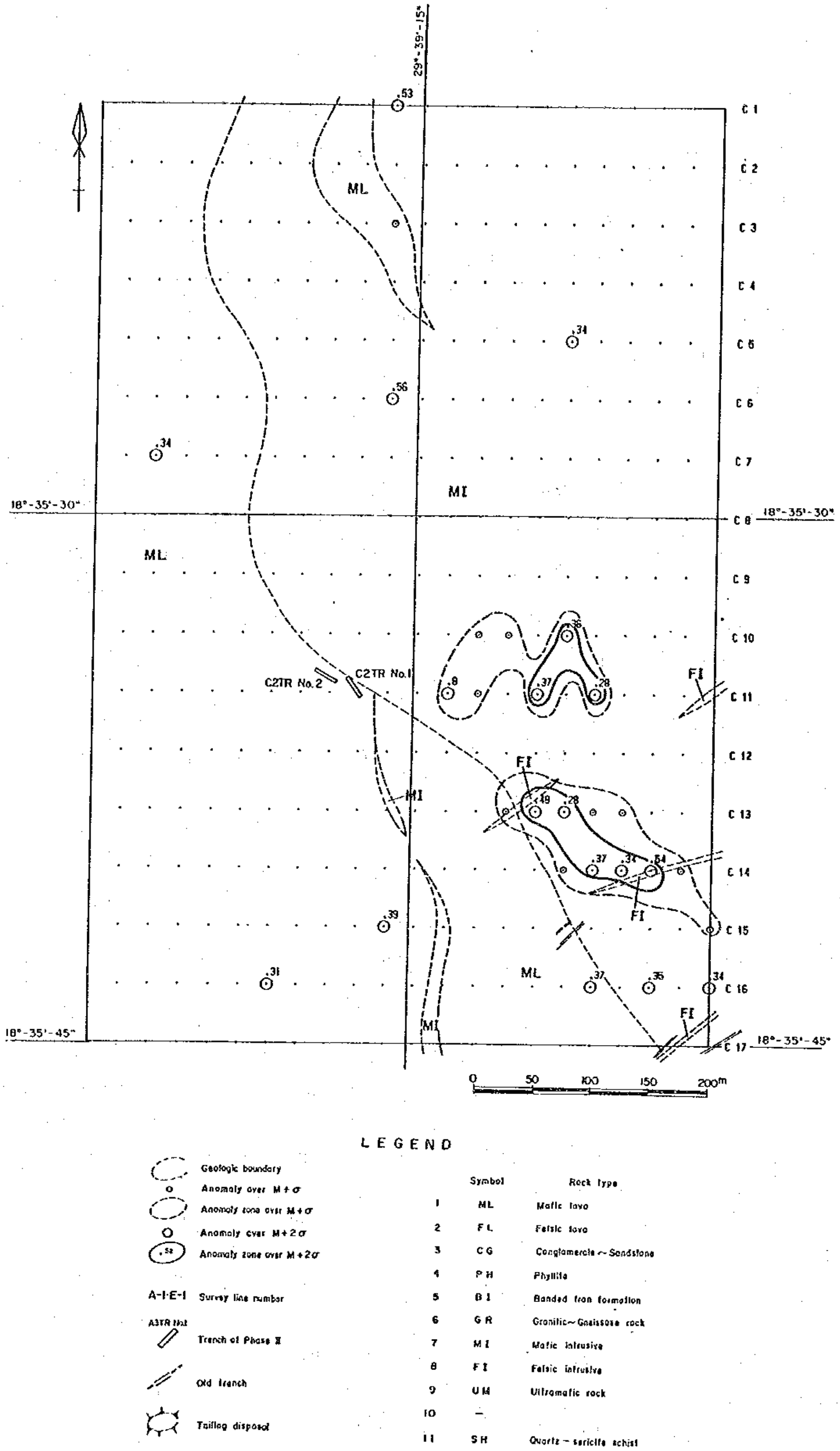


Fig.Ⅱ-3-1 Geochemical Anomaly Map Au of Area C2 bedrock. The bedrock geology is fine grained massive basalt locally silicified with some quartz vein. The jointing includes two systems of N80° E/N20° W.

C2 TR No.2

Surface profile is the same as in trench No.1. The bedrock is composed of fine to medium grained massive basalt, schistose basic tuff showing microfolding, and felsic dyke rock. Basaltic rocks are rarely mineralized.

3-3. Geochemical Suvey

PL. II-3-2 II-3-4 illustrate geochemical anomalies for each element. Table II-3-1 shows the fundamental statistics of each element for each rock type. Table II-3-2 shows the correlation coefficient between element and rock type and Fig. II-3-2, II-3-4 illustrate histograms and cumulative frequency distribution diagrams of elements for each rock type.

Au

Two small anomaly zones are delineated in the southeast of the area, the southern one, being accompanied by 5 A-rank anomalies, trends NW to WNW.

Ag

The anomalies are too erratic to form a zone except for 2 small B-ranked are as in the northwest of the area where no correspondence with the Au-anomaly zone is observed.

As

The trend of the defined anomaly zone corresponds remarkably with the NNW trend of the dolerite dyke in the south central part of the area and encloses 6 A-rank and 7 B-rank anomalies. Other anomaly zones are not important because of their small size and relationship to geology.

3-4. Discussion

Although it still remains obscure whether control the parameter is the contact of the dolerite intrusive or the quartz porphyry dyke,accompanied by quartz veins. Intense Au anomalies, mineralized quartz veins with Cu sulphide,and old trenches are favourable signs of good mineral potential.

Table Ⅱ-3-1 Fundamental Statistics of Each Element for Each Rock Type, Area C2

Element	Rock Type	Number of Smp.	Min. ppm	Max. ppm	Arith. Mean ppm	Std. Dev. ppm	Geomet. Mean ppm	Std. Dev. log
Au	Whole	361	L 50	800	55	92	34	0.32
	ML	151	L 50	390	38	55	30	0.23
	FL	1						
	BI							
	MI	205	L 50	800	64	105	40	0.36
	FI	4	L 50	540	205	211	94	0.59
	GR							
	UM							
Ag	Whole	361	50	1100	120	97	101	0.23
	ML	151	50	500	105	66	92	0.21
	FL	1						
	BI							
	MI	205	50	1100	131	114	109	0.24
	FI	4	100	100	100	0	100	0
	GR							
	UM							
As	Whole	361	6	48	16	5	15	0.13
	ML	151	7	45	16	5	15	0.12
	FL	1						
	BI							
	MI	205	6	48	16	5	15	0.13
	FI	4	14	21	16	3	16	0.07
	GR							
	UM							

Note 1. ML ; Mafic Lava FL ; Felsic Lava BI ; Banded Iron Formation
MI ; Mafic Intrusive FI ; Felsic Intrusive GR ; Granitic Rock
UM ; Ultramafic Rock
2. Grade of Au is ppb.
3. L 50 means less than detection limit (50 ppb for Au)

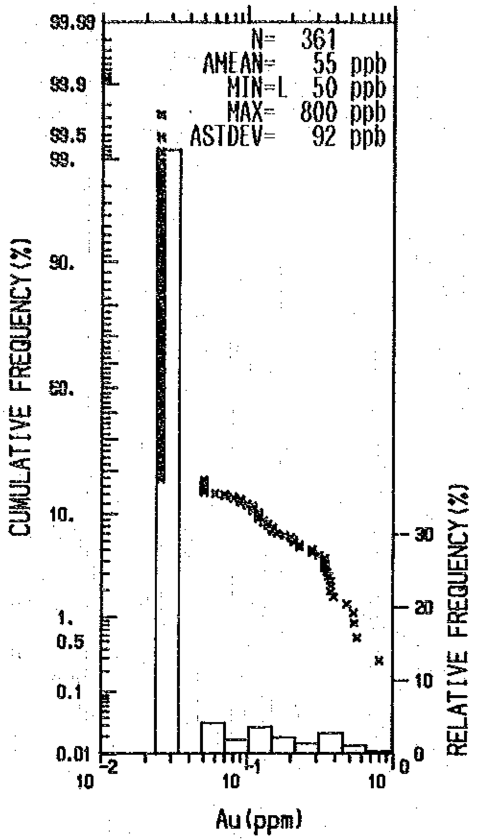
Table Ⅱ-3-2 Correlation Coefficient between Element Area C2

Rock Type	Au－Ag	Au－As	Ag－As
Whole	－0.04 (－0.02)	－0.07 (－0.08)	0.05 (0.06)
M L	0.07 (0.17)	－0.03 (0.02)	0.05 (0.02)
F L			
B I			
M I	－0.08 (－0.13)	－0.09 (－0.11)	0.06 (0.09)
F I			
G R			
U M			

Note＊ M L ; Mafic lava F L ; Felsic Lava B I ; Banded Iron Formation
M I ; Mafic Intrusive F I ; Felsic Intrusive G R ; Granitic Rock
U M ; Ultramafic Rock ( ) ; Logarithmici Data

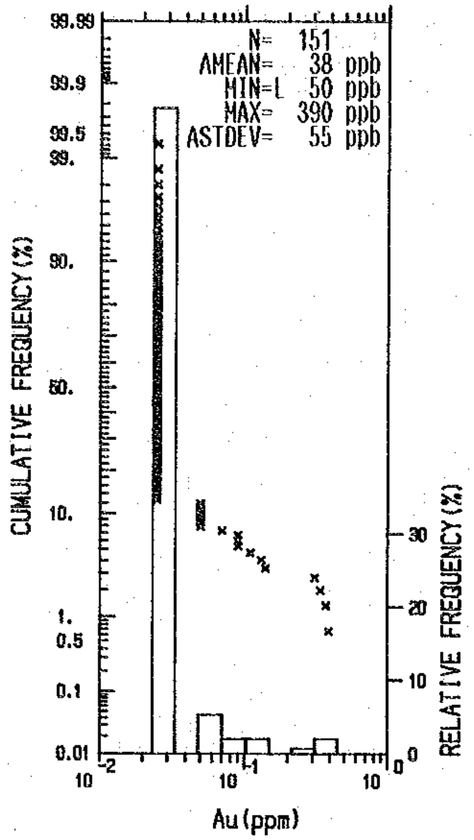
Zimbabwe -C Area-

Whole Type



Zimbabwe -C Area-

Mafic Lava



Zimbabwe -C Area-

Mafic Intrusive Rock

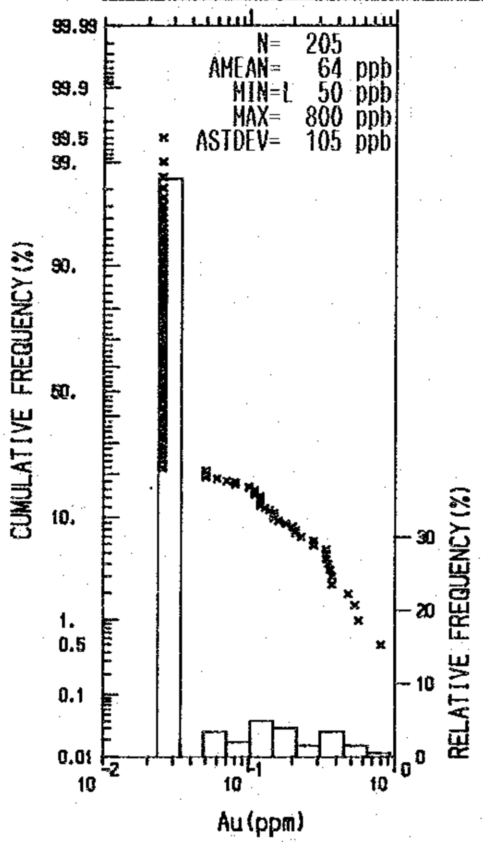
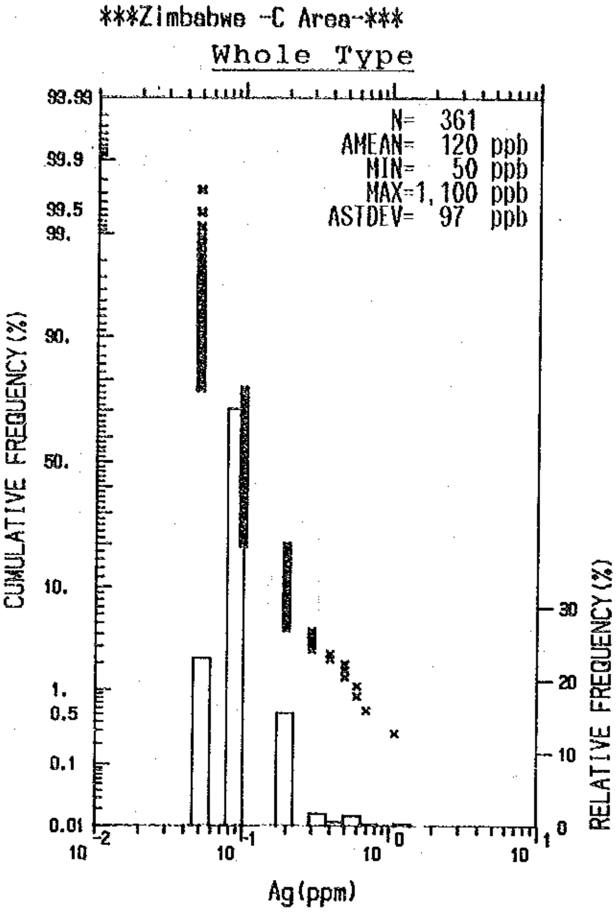
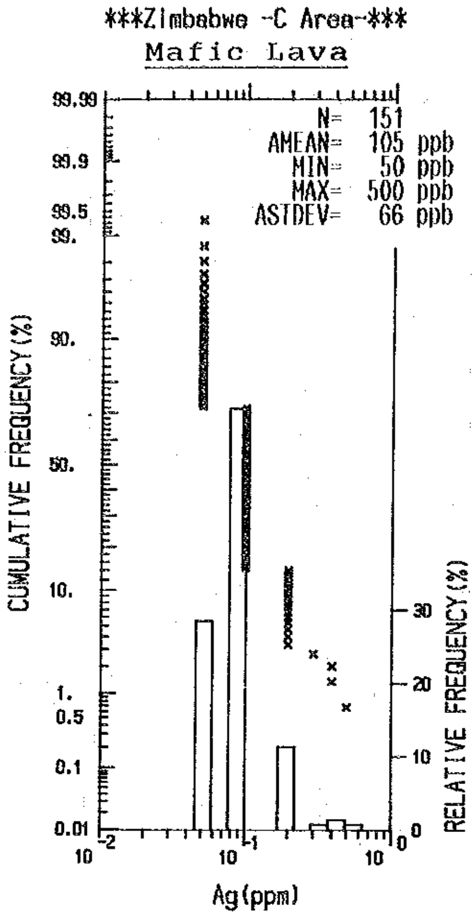


Fig.Ⅱ-3-2 Histogram and Cumulative Frequency Distribution Diagram of Au for Rock Type, Area C2





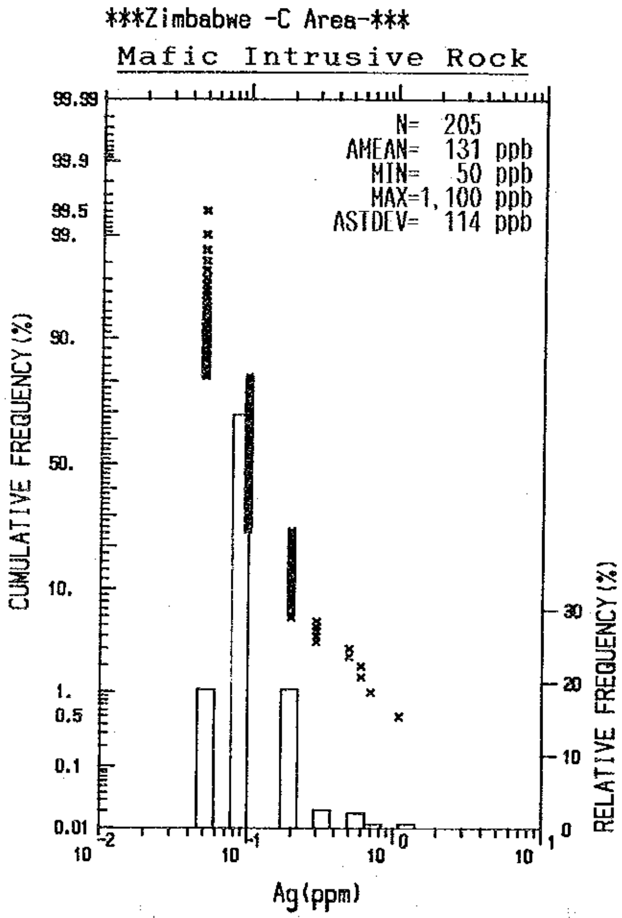
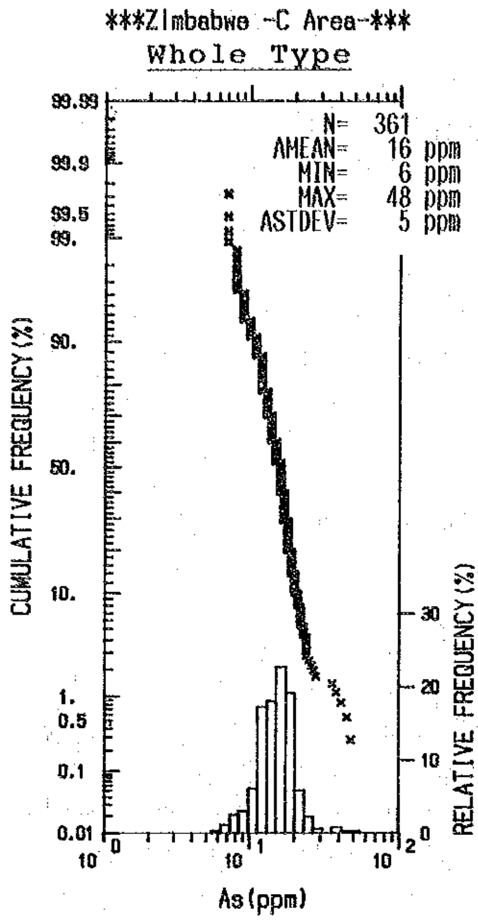
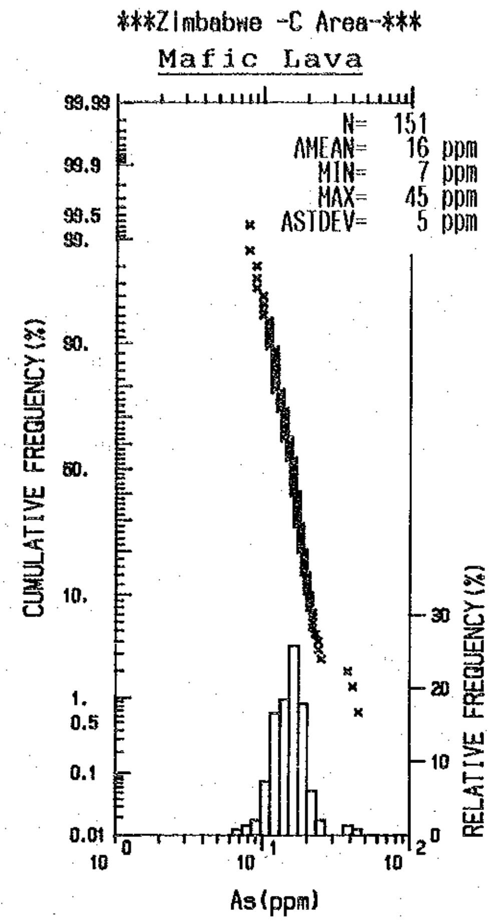


Fig.Ⅱ-3-3 Histogram and Cumulative Frequency Distribution Diagram of Ag for Rock Type, Area C2





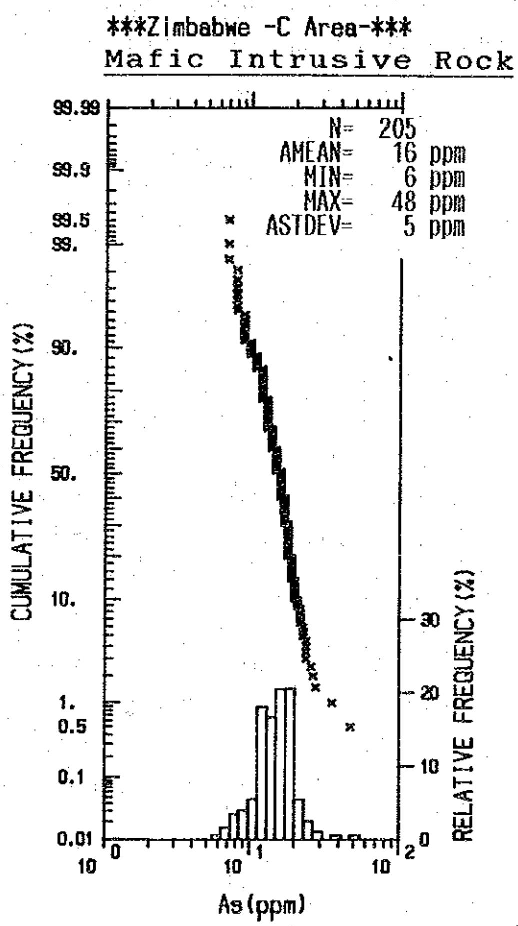


Fig.Ⅱ-3-4 Histogram and Cumulative Frequency Distribution Diagram of As for Rock Type, Area C2

CHAPTER 4 D1 AREA

4-1. Geology

Topogaphy

This is more or less flat land with a very gentle valley running from south to north in the middle of the area. The valley has grass land with poor rock exposure in the dry season and water runoff in the rainy season

Geology

Fig. II-4-1 and PL. II-4-1 is the geologic map of the area. Based upon the distribution of blocks and pebbles, the area consists of basalt, BIF of Upper Bulawayan Group and Kwekwe Ultramafic Complex in this order, from west to east. Talc-sericite schist occurring at the west contact of the Complex, is possibly derived from the margin of the Complex after alteration or metamorphism at the time of emplacement. The BIF is comparatively well exposed, trending N5° W which generally dips eastward at 75-85° . The Ultramafic Complex is greenish brown and has been affected by serpentinization and carbonatization. The serpentine shows a porous rugged surface resulting from the dissolution of the calcite which has replaced olivine and pyroxene.

Mineralisation

A quartz vein trending N65° E and N20° E less than 1 metre thick is found to be hosted within the mafic rock but is barren. In the south, some trenches which trend N50° W remain.

4-2. Geochemical Survey

PL. II-4-2 II-4-8 illustrate the geochemical anomalies for each element. Table II-4-1 II-4-3 shows the fundamental statistics for each element for each rock type. Table II-4-1 II-4-3 show correlation coefficients between element and rock type and Fig. II-4-2 II-4-8 illustrate histograms and cumulative frequency distribution diagrams of element for rock types.

Au

A small anomaly zone composed of 2 B-rank and 2 A-rank anomalies in the northwest and a medium size anomaly zone composed of 10 B-rank and 7 A-rank anomalies in the west, are located within the BIF terrain. The configuration of the anomaly

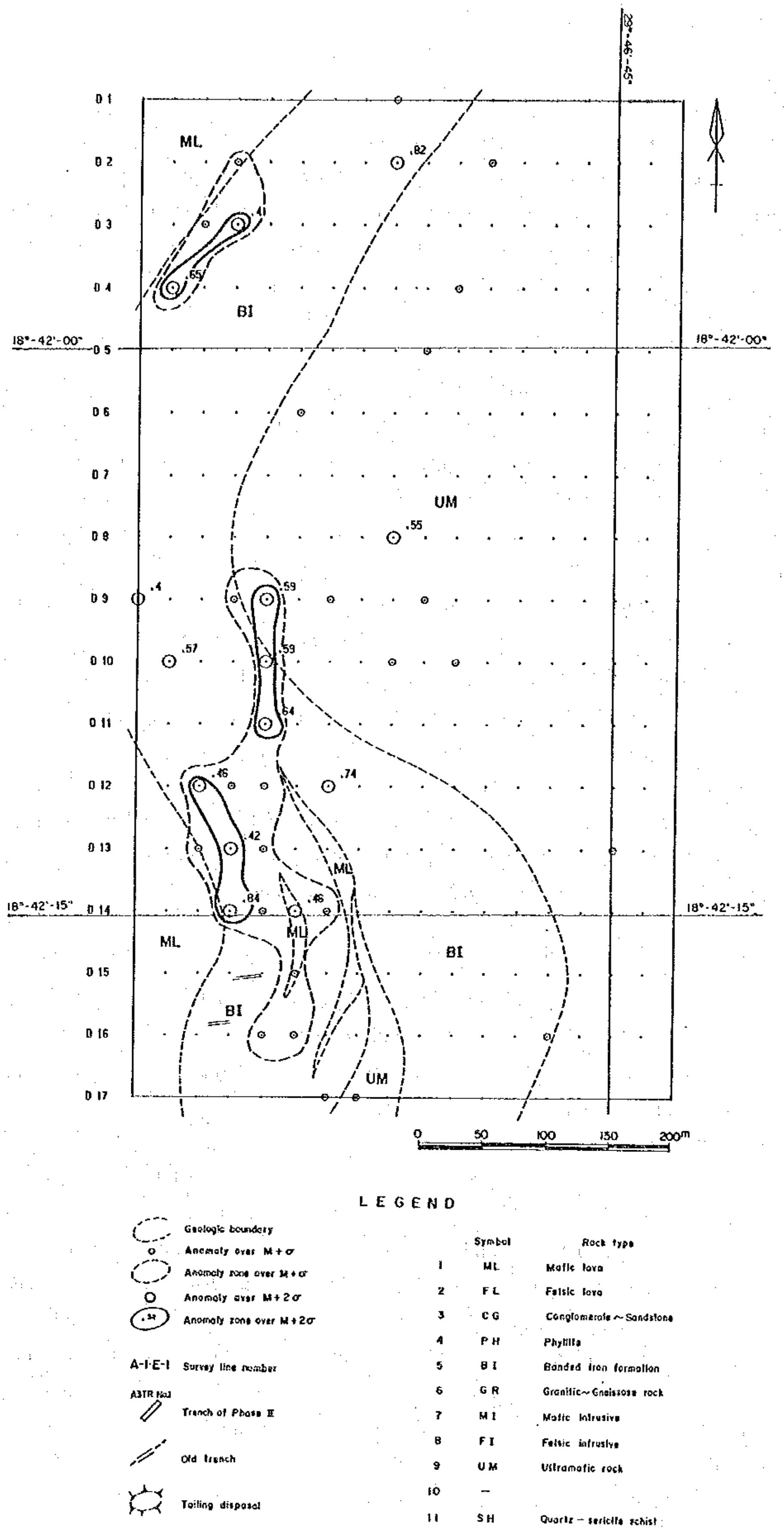


Fig.II-4-1 Geochemical Anomaly Map Au of Area D1 zones has the same NNE to NS trend as the BIF and mafic lava. The intensity of the anomaly, calculated as the A-rank threshold value divided by the mean value for BIF, rarely exceeds around 3.5, because the mean value for BIF is obviously larger than that for the other rock types.

Ag

One B-rank and 3 A-rank anomalies form a small zone within the BIF in the north-central part of the area. The zone contains a B-rank and a few A-rank Au anomalies which do not show very good coincidence with the Au-anomaly zone. At the southern end, two small anomaly zones composed of 3 A-rank anomalies are distributed in BIF and ultramafic rock, but they are separate from the Au-anomaly zone and their configuration poses some technical analytical problems for geochemical evaluation. The intensity of A-rank anomaly zone is 3.3 for BIF and a little more than 4 for ultramafic rock.

Pt

Statistical processing gives all samples an A-rank anomaly because the assay values were all at or below the detection limit, therefore no true anomaly zone is defined here.

Cu

Small anomaly zones consisting of a couple B and A-rank anomalies are scattered in the north and south end of the area. The northern one partly corresponds to the Au-anomaly zone, whereas the southern one overprints an Ag-anomaly zone. But the intensity of the zone is as low as 2.

Ni

The anomalies are restricted to a part of the Ultramafic Complex, as in the case of Co and Cr, in particular 12 A-rank anomalies are concentrated in the bulge in the Complex in the centre of the area. The intensity of the anomaly zone is not so large, varying from 2 to 2.5. The anomaly zone comprising 3 A-rank anomalies on the south is apparently related to the ultramafic wedge intruding into BIF.