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THE ARCHAEAN AND LOWER PROTEROZOIC OF CENTRAL AFRICA

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ABSTRACT Most of central Africa is underlain by Archaean terrains (mostly below a Phanerozoic cover), represented by high-grade gneissic complexes and by low-grade granite-greenstone belts. The lowermost Proterozoic is represented either by gneisses in mobile zones or low-grade supracrustals in forelands. The remaining Lower Proterozoic is made of low-grade supracrustal metasediments in mobile zones. Such zones developed thus almost immediately after the end-Archaean cratonization. The successive mobile zones appear to have developed in a centrifugal pattern during the Lower-Proterozoic. The mineral wealth is unevenly distributed. Only some greenstone belts have given an appreciable gold output, whereas the gneissic Archaean terrains have proven to be almost barren. Iron remains an important resource of the Archaean, as manganese is for the Lower Proterozoic. Uranium and some Cu, Co has been found in the Lower Proterozoic of respectively Gabon and Uganda.

INTRODUCTION[1] Central Africa is defined here as the portion of Equatorial Africa situated west of the Western-Rift. It comprises the following countries: Guinea, Cameroun, Gabon, Congo, the Central African Republic, Zaïre, Rwanda, Burundi, Angola and limited portions of Sudan, Uganda, Tanzania and Zambia.

The physiography of central Africa is in close relationship with the geology of that part of the continent. Surrounding the Congo basin with its late Precambrian and Phanerozoic filling, the highlands situated between the Western Rift and the Atlantic ocean are built up of Precambrian terrains and among them, most are of Archaean age (Cahen, Delhal and Lavreau, 1976). Below this over 3,000 m thick filling (possibly twice this value) granitic and gneissic terrains are found as indicated by seismic exploration (Evrard, 1960); judging from the nearest basement outcrops, they are most probably of Archaean age as well.

Only a limited portion of the Western part of the sub-continent shows Proterozoic terrains disconnected from an Archaean neighbourhood, but even there, isotopic indications point to nearby or precursory Archaean elements. In this synthesis, we will first define the Archaean and Lower Proterozoic terrains along a geographic trend, later on we will describe the condition of their genesis and evolution and finally we will give some information about their metallogenic wealth (Figure 1).

THE ARCHAEAN OF NORTH CENTRAL AFRICA

The Ntem Complex of Cameroun This complex, also called "Complexe calco-magnésien du Sud Cameroun" (Gazel, Hourcq and Nicklès, 1956), spans the frontiers of Cameroun with Equatorial Guinea, Gabon and Congo. It is made up of a variety of rocks of granulite facies metamorphism which have suffered cataclasis and recrystallization and locally retrograde metamorphism (Delhal and Ledent, 1975; Lasserre and Soba, 1976). In places they have been affected by the granitisation of the du Chaillu massif (*see further on*).

The Nyong gneisses or pyroxene gneisses of the lower Nyong and Loukoudi "series", just west of the Ntem massif, are part of a complex containing biotite gneisses and migmatites. These rocks have been affected by a late Precambrian to Lower Palaeozoic (?) reworking which is characterized by a NNE regional folding (Champetier de Ribes and Reyre, 1959).

Granitoids of charnockitic character yielded Rb:Sr isochron of 2.80 Ga (Lasserre and Soba, 1976). Various Nyong gneisses and amphibolites yielded a Rb:Sr isochron of 2.96 Ga (Lasserre and Soba, 1976) whereas most mineral ages are about 510-520 Ma except for biotites from pyroxene gneisses of Lolodorf and Eseka giving K: Ar ages of 2.02 Ga and 2.30 Ga, the respective Rb: Sr model ages being much younger (Lasserre, 1966).

The Bomu Complex of Central African Republic and Zaïre High-grade gneisses are encountered in several places in the Central African Republic, as granitic gneisses or migmatitic complexes in the "Complexe de Base" of that country (see Mestraud, 1964). Their geochronology is still in progress. Most characteristic are the amphibole-pyroxenic (often garnetiferous) gneisses which are crossed by the Bomu river (and the CAR-Zaïre border) between meridians 22° and 25° E. This extensive mafic gneiss association constitutes apparently the lowermost element of the Bomu Complex. They are associated with gneissic series where metasediments are abundantly represented (Bereme e Monga gneiss in Zaïre, Série silico-alumineuse in CAR) among less typical grey gneisses and granites (Nzangi gneisses in Zaïre) (Lavreau, 1980).

The Bomu Complex is surrounded by late Precambrian series except on its South-eastern flank where it is intruded by the "Massif granitoïde du Haut-Zaïre".

[1] Many elements of the following account are based on the synthesis of Cahen and Snelling (*in press*).

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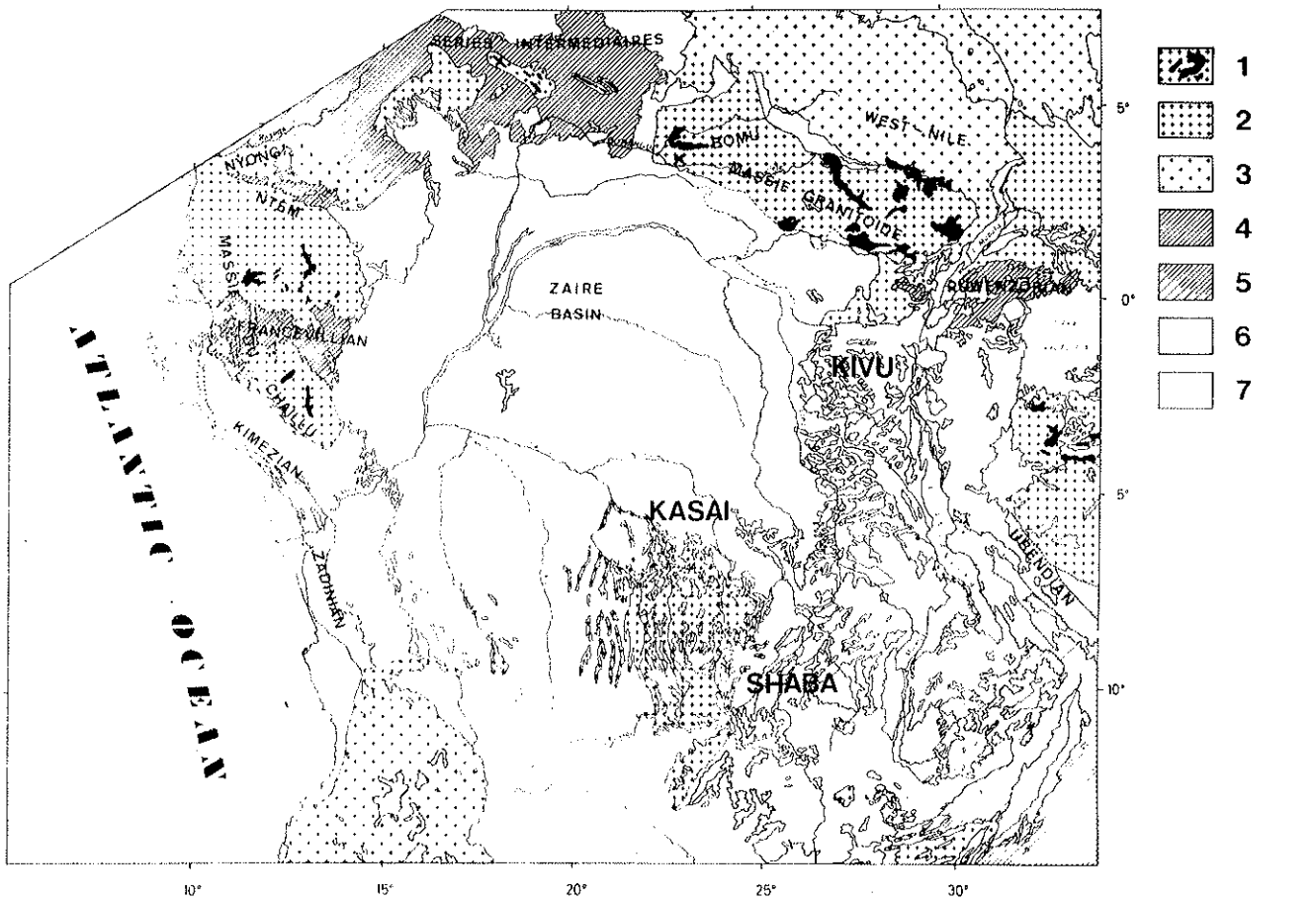

Figure 1 – Geological sketch of Central Africa (modified from the Geological Map of the World, UNESCO) – 1-3: Archaean (1: granite -greenstone association; 2: high-grade terrains; 3: Archaean reactivated during the Upper Proterozoic); 4-5: Lower Proterozoic (5: Lower Proterozoic reactivated during the Upper Proterozoic). 6: Middle and Lower Proterozoic. 7: Phanerozoic

The chronological frame of the Bomu Complex is well established: a thermo-tectonic event has been recorded within the mafic gneisses and the Nzangi granitoid gneisses at 2.98 Ga. The supracrustal rocks of the Ganguan (see "The granite-greenstone belts of N. Zaïre and the CAR") contain galenas within quartz veins the model age of which is about 3.2 Ga; these rocks overlay the gneissic ones of the Bomu Complex. The granitoid precursors of the Nzangi gneisses have been dated at 3.42 Ga with a Pb-Pb isochron.

Finally, granitic batholits (Bondo granite) intruded the Nzangi gneisses at 2.5 Ga. The evolution of the Bomu Complex thus spans 1 billion years (Lavreau, 1980).

The granite-greenstone belts of N. Zaire and the CAR Granitoids form an important part of the Precambrian in N. Zaïre, whereas they are represented in CAR only by elongated patches surrounded by high-grade and medium-grade terranes. Their diagnostic association with greenstone and schist belts has been recognized only recently (Lavreau, 1973; Cahen *et al.*, 1976; Poidevin *et al.*, 1981).

The Bandas greenstone belt of CAR is composed of metatholeiites and some itabirites; it is intruded by tonalites, some 2.8 Ga old (Lavreau, Ledent and Poidevin, 1980). In Zaïre, the greenstone belts are referred to as the "Kibalian" or as the "Ganguan". They form a dozen of 10 to 100 km^2 wide zones mainly composed of metavolcanic rocks and some sediments. Several of these zones show "upper Kibalian" sediments (with some andesitic volcanics) resting upon a "lower Kibalian" (volcanics)-granitoid association. The volcanic members are akin to oceanic tholeiites and to andesites. The sediments are represented by various pelites and characteristically by itabirites. The "lower Kibalian" is intruded by 2.81 Ga .old tonalites, whereas the "upper Kibalian" is intruded by granites 2.46 Ga old (Lavreau and Ledent, 1975; Lavreau, 1980).

The "Ganguan" schist belt resting upon the Bomu gneisses is composed of metasediments (quartzites, slates) and volcanics (talc schists). It is older than 2.9 Ga because it is involved in a tectonic phase dated within the gneissic basement, which supports to the quoted 3.2 Ga model age.

The West-Nile gneissic Complex of Sudan, Uganda and Zaire These gneissic series constitute the Basement Complex of Uganda, Southern Sudan (both East and West of the Nile notwithstanding the name of the Complex) and N. Zaïre. Except for the West-Nile District of Uganda studied by Macdonald (1963) and Hepworth (1964), and the neighbouring districts of Zaïre known by extrapolation from the former (Lavreau, 1980), it is generally poorly studied.

The oldest assemblage (the "Watian group" composed of sediments and granitoids) has been refolded (on E-W

trending flanks) in granulitic condition 2.91 Ga ago (Leggo, 1974; Lavreau, 1980). A younger one (the "Aruan group composed of sediments and volcanics but where granitoids are overwhelming) has experimented several tectono-thermal and intrusive episodes, at 2.67 Ga (tight folding on N-S trending axial flanks migmatites), 2.64 Ga (monzonites), 2.55 Ga (open folds?) and 2.42 Ga (granites). The last events have also affected a schist belt (the "Kibalian" of West Nile), mainly composed of hornblende schists.

Several patches of 'Watian' terranes have been recognized in Uganda and Sudan on the base of the peculiar E-W trending structures and metamorphic grade; they are surrounded by migmatitic gneisses attributed to the Aruan or to retrograded Watian rocks (Almond, 1969).

The Archaean around the Western Rift Only restricted outcrops of proved Archaean terrains have been observed on the Western side of the rift. The granite-greenstone belt association of N. Zaïre, can be recognized as far as the Equator. South of this line, the Kivu and Northern Shaba regions show some high-grade gneiss spots of presumably Archaean, age, but no radiometric data are available as yet.

On the eastern side of the rift, the Basement Complex extends to the northern range of the Ruwenzori mountains, *i.e.* about as far southwards as the granite-greenstone terranes of Zaire.

Achaean ages have been expected, and found, in Southern (Kikuka Complex) and in Eastern Burundi (within the Cankuzo "arena"): these respectively sub-granulitic gneisses and granites have indeed been dated at 2.5-2.6 Ga (Demaiffe and Theunissen, 1979; Ledent, 1979). In Eastern Kivu, north of lake Tanganyika, rocks older than the Ubendian (Lower Proterozoic) event are expected on structural grounds (Villeneuve, 1979). They link with the Tanzania shield (comprising both high- and low-grade terrains) whose the Archaean age of which has long been known (see Cahen and Snelling, 1966). The same applies in the "Muhila Complex" of N. Shaba, where banded iron-stone, cherts and other rocks possibly represent a greenstone remnant presently isolated from the Tanzania shield.

Several high-grade gneiss units are known in Zambia and W. Tanzania (Songwe, Chambo, "cordierite" gneisses) that were retrograded during the Lower Proterozoic (Ubendian event), most of them are probably Archaean, but the Proterozoic overprint has erased their pristine radiometric features.

The Archaean of Angola and Kasaï The Archaean basement of Kasaï and Angola comprises several granite-gneissic assemblages (Delhal, Ledent, and Torquato, 1976):

1. Pre-granulite facies metamorphism gneissic rocks
2. The gabbro-norites and charnockites of Kasaï-Lomami and Malange-Dondo
3. The migmatites and granites of Dibaya
4. The gneisses of Western Shaba situated south of assemblage 2.

The first assemblage is known in areas devoid of granulite facies metamorphism. The Upper Luanyi gneisses have yielded an age of about 3.4 Ga relative to an undefined event; the Kanda-Kanda tonalites are about 2.8 Ga old (Delhal, 1977).

The second has been dated with the aid of hololeucocratic rocks associated with the "charnockitization" event at 2.77 Ga. These rocks form lenses and dykes cutting through charno-enderbites and paragneisses, and appear as a product mobilized during that event.

The vast assemblage of calc-alkaline granite and granitic to tonalitic migmatites of Dibaya spreads northwards below the Phanerozoic cover and westwards to the Kwango river. The granites have been dated at 2.59 Ga, whereas the migmatites experimented a thermo-tectonic event at 2.68 Ga following a long crustal history (Delhal *et al.*, 1975).

Unpublished work (Delhal, Liégeois) one gneisses from S. Kasaï and W. Shaba in Zaïre also points to ages in a span of 2.7-3.1 Ga.

The granulite facies assemblage extends through Angola (Calonga, Cuango, Malange, Dondo), *i.e.* almost to the Atlantic coast. It has been dated near Cuango at 2.79 Ga, *i.e.* a value similar to that recognized in Kasai (Delhal, Ledent and Torquato, 1976).

Mendes-Vialette (1972) has obtained an age of 2.74 Ga on gneisses neighbouring Andulo.

A vast expanse of Archaean terranes thus exists in central Angola, below the Phanerozoic cover.

The Archaean of Gabon: the du Chailu Massif This vast, mainly granitoid massif stretches from Congo (the du Chaillu Massif proper) to N. Gabon and Cameroun (North Gabon granitoid Massif) from which it is separated by the overlying Francevillian.

Various types of granitoids exist (biotite-amphibole grey granodiorites and quartz-diorites and "pink" potassic granites often producing migmatites, a.o. within the southern flank of the Ntem Complex of S. Cameroun and N. Gabon) (Hudeley, 1970).

Schist and greenstone belts (banded iron formation, amphibolites, quartzites) constitute septa within the granitoids.

The intrusion of some of the granitoids have been dated at about 2.7 Ga (Bonhomme and Weber, 1969), a result in keeping with the age found in the migmatitized part of the Ntem Complex.

THE LOWER PROTEROZOIC The Lower Proterozoic of Congo and Gabon: the Francevillian The Francevillian lies unconformably upon the du Chaillu Massif; it occurs in several basins distributed east and west of a N-S-trending granitic ridge. Folded in the northern portion of the eastern area, it is epicontinental and only slightly folded in the S-W area. It has been subdivided in five lithostratigraphic units:

FA: Basal sandstone (0-1,000 m), conglomeratic along the edge of the du Chaillu Massif
FB: Sandy pelitic and lower volcano-sedimentary unit, locally dolomitic, locally carbonaceous
FC: Carbonaceous pelites in alternation with jaspers and cinerites
FD: Carbonaceous pelitic and upper volcano-sedimentary unit
FE: Upper sandstone

The N'Goutou subvolcanic complex presumably follows Fa (Weber, 1969).

The deposition of the Francevillian began after 2.7 Ga. The age of the N'Goutou volcanism has been estimated with the aid of a syenitic phase at 2.14 ± 0.07 Ga (Bonhomme and Weber, 1969), whereas the first concentration of uranium by diagenesis in FA and following are dated at 2.05 ± 0.53 Ga (Gaucarz, 1978).

Other dates between 1.98 and 1.70 Ga can be referred to various stages of diagenesis and end of cooling.

The Lower Proterozoic of Cameroun, Central African Republic and N-W Zaïre No Lower Proterozoic terrains have been recognized as such in these countries. Fairly well supported candidates exist however among the *Séries intermédiaires*, *i.e.* belonging neither to the basement nor to the cover but showing some of the structural features of both (see Bessoles and Trompette, 1980).

In Cameroun, the series of Loni, Poli, Mbalmago-Bengbis, Agos, Schist-quartzitic are conglomerates, volcano-sediments, pelites metamorphosed in the greenschist facies.

In CAR, the series of Bole represent the extension eastwards of the Mbalmago-Bengbis-Agos and Schist-quartzitic series of Cameroun; in the central region of the country, a quartzitic formation (Mobaye, Madongere...) has been distinguished from a metapelitic one (Atta, Yangana Bangui-Ketté) composed mainly of sericite and chlorite-schists with some quartzitic beds.

They are older than formations which have been correlated, on various grounds, with the more adequately dated West-Congolian formations of late Precambrian age: they are thus older than 1 Ga. They must be younger than the Ntem Complex of Cameroun and the Banda greenstone belt of CAR, *i.e.* 2.8-2.9 Ga.

The "Yangana" and "Mobaye" series extend in NW Zaïre where they have been called *Complexe inférieur de l'Ubangi*. This complex is overlain by the Liki-Bembe series, equated with the Ituri of late Precambrian age, thus a situation similar to that found in Cameroun.

The reason why they are thought to be of Lower Proterozoic affinity is the fact that the Archaean rocks (the Ntem Complex) show the effects of isotopic disturbances dated at about 2 Ga along the contact zone with the *Série intermédiaire*. Where the late Precambrian overprint is strongest, *i.e.* Northward, the "intermediate" series can hardly be distinguished from the younger terrains.

The Lower Proterozoic of N. Zaïre (Kivu) and Uganda The Ruwenzori fold belt (Tanner, 1973) stretches E-W along the Equator between meridians 33°30′ and 28°30′E; through the districts of Buganda and Toro in Uganda, and N. Kivu in Zaïre.

In Central Uganda, the rock sequence of the "Buganda group" is: a prominent basal unit with several quartzite bands sometimes conglomeratic and phyllites, slates and shales. It is overlain by slates, some phyllites and shales which are succeeded by basic volcanics, amphibolites and tuffs, with some ultramafic rocks (King and De Swardt, 1970; Brinckmann and Gabert, 1977).

The group is transgressive over the Iganga granite (2.54 Ga old, Leggo, 1974). Younger time-limits are given by biotites from the Mubende granite which is intrusive into the group (1.81 Ga, quoted by Cahen and Snelling, 1966) and by K/Ar ages on sediments (1.86 Ga, Harper *et al.*, 1972).

The "Toro system" of western Uganda consists of pelitic and semi-pelitic micaschists (Igara schists) with occasional quartzites and amphibolites associated to the latter (Reece, 1961).

The metasediments of the Ruwenzori range are included in the "Toro system": quartzites and conglomerate at the base, followed by tholeiitic lavas and sills, metamorphosed pelites (andalusite-cordierite, sillimanite-muscovite), banded amphibolit rocks and dolomitic marbles. The sequence is thus very similar to the Buganga group (Tanner, 1973). The group rests unconformably upon the basement gneisses. To the south, a granite (Masha arena) bordered by Toro rocks yielded ages of about 1.9 Ga (Vernon-Chamberlain and Snelling, 1972) whereas a muscovite from a schist has a K:Ar age of 1.81 Ga (Lwanda unconformity, Masaka) (Cahen and Snelling, 1966), a biotite from an andalusite schist gives a K:Ar age of 1.83 Ga (Ruwenzori, Stuhlmann Pass) (*ibidem*).

Refoliated (?) basement rocks from the Ruwenzori gave a Rb/Sr age of 2.1 Ga (Bailey, 1973).

The Luhule-Mobisio series of N. Kivu constitutes the western continuation of the Butiti and Baker syncline of the Ruwenzori range. Rock formations situated south of the Luhule-Mobisio synform could also belong to the Buganga-Toro supergroup.

The Ubendian belt along the Western Rift Various localities in Rwanda show some gneisses and migmatites in regions where metasediments soaked with pegmatitic granite material are usually found, suggesting the existence of older remnants within the Middle- to Upper-Proterozoic terrains. These gneisses have indeed given U-Pb (zircon) and Rb-Sr data pointing to an age of about 1.9-2.06 Ga (Gerards and Ledent, 1976).

The Ubendian belt of Tanzania comprises several gneiss units and metasedimentary series (Ubende series, Wakole series, Ufipa gneissic complex, Maholi gneiss, Kabungu series, Ikulu series) which have fairly been correlated with the Misiku belt of Malawi and NE Zambia (Songwe gneiss, Chambo gneiss, "cordierite" gneisses).

The gneiss complexes are considered to have retrograded during the Ubendian event (the high grade assemblage are thus probably Archaean). Some of the metasediments have been correlated with more intensely metamorphic units, the chronological status of which is still pending.

Radiometric data of about 1.8-2.0 Ga relate to post-Ubendian events (Cahen and Snelling, 1966; Dodson *et al.*, 1975), the peak of the Ubendian orogeny being considered to have been reached around 2.05 Ga (Cahen, pers. comm.)

In W. Tanzania, a Chocha group of metasediments (greywackes, slates, arkoses, quartz-schists) and acid volcanics (Kate porphyries) have an unconformable relationship with the Ubendian rocks. Both are intruded by the 1.84 Ga old Kate granite (Schandelmeier, 1978, unpubl.).

The region bordering Zambia, Tanzania and Zaïre, sometimes referred to as the "Bangweulu block" is limited by Upper- to Middle-Proterozoic terrains and structures. It shows, on its western flank, an association of acid volcanics (rhyolitic, dacitic) with minor quartzites and schists. The volcanites have been dated at 1.82 Ga (Brewer *et al.*, 1979).

The same volcanics are found in the Shaba region of Zaïre (Marungu porphyries).

The Lower Proterozoic of Shaba, Kasaï and Angola The Luiza metasediments (quartzites, micaschists, ironstones) of Kasaï have been tectonized together with their gneissic basement (from which the chronological data comes) at 2.41 Ga (the Mubindji event) (Delhal and Ledent, 1973).

Dates in the 2.2-2.0 Ga range are given by Luizan muscovites but are also encountered in other regions of Shaba and Kasaï where the 2.42 Ga event is not known.

Metasediments around Mufo in NE Angola can be parallelized with the Luiza of Kasaï on lithological grounds.

The Lukoshi metasediments around Kisenge (including Mn deposits) are cut by pegmatites giving a younger age limit for these rocks at 1.92 Ga.

Numerous anorogenic granites (Kapanga, Lunde, a.o.) have given ages slightly older than 2.0 Ga (Delhal and Ledent, 1973; Delhal and Liégeois, to be publ.).

One can therefore suggest (Cahen, pers. comm.) that a tectono-thermal event in the 2.0-2.2 Ga range existed which was distinct from the more local and older Mubundji event.

South-West Angola shows, unconformably overlying high-grade basement rocks of presumed Archaean age, the epimetamorphic series of Jamba (volcano-sedimentary with abundant ironstones) itself in turn overlain by the Chivanda series (volcano-sedimentary, with Mn-shales) possibly covered by acid volcanics; anorogenic granite loccoliths intruded the three formations in the time range 1.85-2.04 Ga post-dating the tectonic phase affecting the Chivanda series. The detrital Ouendolongo series are considered to be the molasse associated with the post-Chivanda tectonism (Bassot, Pascal and Vialette, 1981).

A possible link between the Luiza-Mufo and Jamba on one hand and Lukoshi-Chivanga on the other can tentatively be drawn.

The Lower Proterozoic along the Atlantic In NW Angola, the 1.95 Ga old Vista Alegre pluton intrudes the "Lundo arkoses" belonging to a group of metasediments and gneisses trending NE, lying unconformably upon an Archaean high-grade gneissic basement (Cahen, Kröner and Ledent, 1979).

In Lower-Zaïre, the Kimezian gneisses and migmatites were originally metamorphosed in the amphibolite facies, during the Tadilian orogeny, 2.12-1.95 Ga ago (Cahen *et al.*, 1978; Delhal and Ledent, 1976).

In Gabon, the *Groupe des gneiss à plagioclase acide* are presumed to correspond to the Kimezian (Cahen, 1977*b*); they are superposed in N. Mayombe to older rocks. In N. Gabon, the Archaean du Chaillu Massif is indeed reworked during a younger event probably equivalent to the Tadilian phase.

The Zadinian terrains of Lower-Zaïre and Angola, known in the latter country as the Western facies of the Lulumba and Vonde subdivision, comprise two distinct groups: a lower one composed of micaceous quartzites, micaschists and acidic lavas, an upper one beginning with mafic lavas (The Gangila lavas) and followed by schists (chlorite, sericite), quartzites and acid pyroclastics (Cahen, 1977*b*). It was originally folded upon ENE to NNE axes (Cahen, 1977*a*), the intensity of this folding increasing towards the South: in Lower Zaïre, Congo and Gabon, this group is probably less affected.

ARCHAEAN HIGH- *vs* LOW-GRADE TERRANES

The geochronological data point to a penecontemporaneous and parallel evolution of the high-grade terranes, represented by gneissic complexes with granulitic elements, and the low-grade terranes, represented by the granite-greenstone belts.

In N. Zaïre, the tectono-magmatic events of 2.91 Ga, 2.67 Ga, 2.55 Ga, 2.42 Ga in the West-Nile gneissic Complex thus find a counterpart in the post-cinematic granitoids of the "Massif granitoïde" intruded 2.8 and 2.45 Ga ago; ages in the range 2.8-2.96 Ga in the Ntem Complex of Cameroun find their counterpart in the 2.7 Ga age of the du Chaillu Massif, in Kasaï and Angola, the "charnockitic" event of 2.77 Ga in the Kasaï-Lomami is balanced by the 2.6 Ga granitic intrusions of Dibaya and elsewhere in Angola.

Recent studies point to an "oceanic" origin for the granite- "primary" greenstone association, whereas the development of the granulitic and migmatitic assemblages require a continental environment (as also do the "secondary" greenstone belts) (Windley, 1976).

Development can be searched for in a mechanism implying horizontal movements on the Earth surface, a.o. in the form of plate-tectonics (Lavreau, 1980).

The late Archaean events, represented by granitoid intrusions, have stabilized the central part of the region under review. More eccentric regions will soon be reactivated during the Lower Proterozoic.

LOWER PROTEROZOIC MOBILE ZONES

Demonstrated or supposed Lower Proterozoic terranes exist in the Northern (Francevillian, Zadinian, "Intermediate"...), Eastern (Buganda-Toro, Lower-Plateau, ...) and Southern regions (Luiza, Jamba, Lukoshian, Chivanga, ...); they are here represented by low-grade supracrustal rocks. High-grade Proterozoic terrains exist as well, *e.g.* among the numerous gneissic series of Tanzania, or in the Kimezian terrains of Lower-Zaïre (elements of them could however contain reactivated Archaean rocks). These series being often unconformably overlain by the former low-grade terrains, they must belong to a lowermost division of the Proterozoic.

Even if notable exceptions exist, it thus appears that high-grade metamorphic conditions have affected the lowermost Proterozoic terranes, whereas only low-grade conditions have reached the younger ones, *i.e.* the remaining Lower-Middle- and Upper-Proterozoic terrains (at least in the areas situated outside the Panafrican orogenic belt of N. Cameroun and CAR, cf. Bessoles and Trompette, 1980).

Most of these series form belts comprising both Lower Proterozoic and reactivated older rocks and must thus be considered as forming mobile zones.

REPARTITION OF MINERAL WEALTH

Most of the mineral wealth of central Africa comes from Middle-Proterozoic (Sn, Nb, Ta, Li, W, ...), Upper-Proterozoic (Cu, Co, U, Zn, ...) or Phanerozoic terranes (diamonds, coal, oil and gas), whereas the contribution of the older terranes is much scarcer.

Only limited portions of the greenstone belts have shown appreciable gold contents; *e.g.* the eastern lower-Kibalian zones of N. Zaïre, where about 350 t of gold have been mined (Lavreau, 1979). The limited occurrences of similar terranes in CAR, Congo or Gabon have proved to be almost barren; only the Nyanzian greenstones, equivalent to the lower-Kibalian, situated in East-Africa, have given a relatively important output. Abundant but unexploited resources in iron exist in N. Zaïre as well.

No resources have at present been found in the high-grade gneissic terranes.

The Lower Proterozoic of Gabon (*i.e.* the Francevillian) has shown to contain both uranium and manganese. The Lukoshian of Western Shaba and the equivalents in Angola are manganesiferous as well, whereas some copper and cobalt exist in the Ruwenzori range (Kilembe).

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