GEOLOGY OF THE NIGERIAN ANOROGENIC RING COMPLEXES

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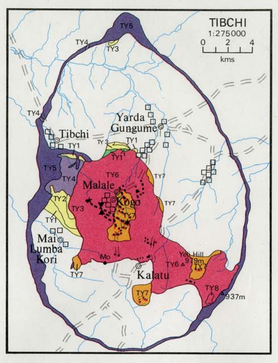
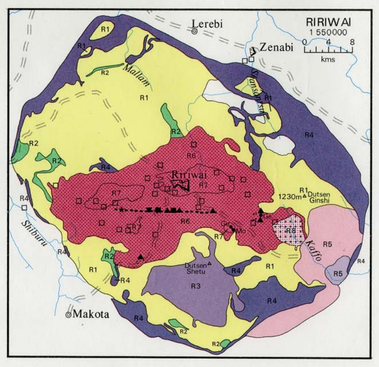
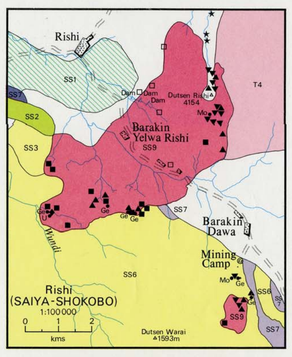
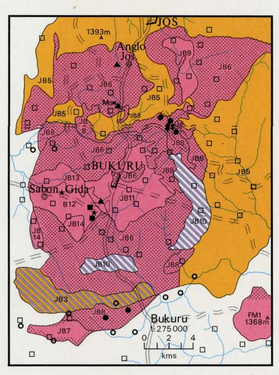








Index

AFU
AF0 Biotite granite : ? Basement
AF1 Quartz porphyry
AF2 Granite porphyry
AF3 Biotite granite
AF4 Biotite granite
AF5 Biotite granite locally with zinnwaldite albite granite
M. P. Jones (2c), A. N. Dempster (3) modified by(1)

AMO
AM1 Granite porphyry
AM2 Riebeckite annite granite
AM3 Hornblende biotite granite
AM4 Biotite granite
AM5 Biotite granite
AM6 Porphyritic biotite granite
AM7 Biotite granite
AM8 Biotite granite
AM9 Hornblende biotite granite
AM10 Arfvedsonite albite granite
AM11 Biotite microgranite
W. N. MacLeod (2b)

AMPAN
AP1 Agglomerate
AP2 Fayalite hedenbergite Ca-Na amphibole syenite, quartz syenite with marginal granite
D. C Turner (1) J. N. Bennett (1)

BANKE
B1 Pre-caldera ash fall tuffs, crystal-poor ignimbrites and minor comenditic ignimbrites
B2 Basaltic lavas
B3 Intra-caldera ignimbrites : mainly crystal-rich
B3' Vertically banded crystal-rich ignimbrites
B4 Intra-caldera crystal-rich ignimbrites
B5 Granite porphyry
B6 Biotite granite with marginal microsyenogranite
W. N. MacLeod, R. R. E. Jacobson and R. Black (2a), J. N. Bennett (1), R. Busari (3)

BIRNIN KUDU
BK1 Crystal-poor ignimbrites
BK1' Crystal-rich ignimbrites
BK2 Granite porphyry
J. N. Bennett (1)

BUJI
BJ1 Pre-caldera agglomerates, crystal poor ignimbrites and ash fall tuffs
BJ2 Intra-caldera crystal-rich ignimbrites
BJ3 Quartz porphyry
BJ4 Granite porphyry
BJ5 Aegirine granite
BJ6 Biotite granite
BJ7 Arfvedsonite albite granite
W. N. MacLeod (2b)

DAGGA ALLAH
DA1 Granite porphyry
M. S. Buchanan (2b), G. Staley (3)

DAURA
DR1 Agglomerates, ash fall tuffs, ignimbrites and minor comenditic ignimbrites
DR2 Porphyritic hedenbergite Ca-Na amphibole quartz syenite
DR3 Biotite granite
D. C. Turner and P. K. Webb in J. Geol. Soc. Lond 1974

DOGO DUTSE
Not mapped in detail
DD1 Aegirine granite
J. N. Bennett (1)

DUTSE
D1 Agglomerate
D2 Fayalite hedenbergite syenite
D3 Porphyritic aegirine arfvedsonite granite
D4 Aenigmatite aegirine arfvedsonite granite
D5 Albite aegirine microgranite
J. N. Bennett (1)

DUTSEN WAI
DW1 Biotite granite
DW2 Biotite microgranite
DW3 Arfvedsonite albite granite
S. I. Abaa (1), R. R. E. Jacobson and W. N. MacLeod (2a)

FAGAM
Not mapped in detail
F1 Volcanic rocks
F2 Granite porphyry
F3 Mainly arfvedsonite granite
F4 Biotite granite
E. H. Jacques (2c), D. C. Turner (1), J. N. Bennett (1)

FORUM
FM1 Biotite granite
W. N. MacLeod and N. G. Berridge (2b)

GAMAWA
G1 Agglomerates, tuffs and breccias
G2 Arfvedsonite granite porphyry
G3 Fayalite hedenbergite syenite, aenigmatite Ca-Na amphibole quartz syenite
G4 Biotite arfvedsonite granite
R. R. E. Jacobson and W. N. MacLeod (2a)

GANAWURI
GN1 Hornblende biotite granite
GN2 Porphyritic biotite granite
GN3 Granite porphyry
GN4 Biotite granite
GN5 Fayalite hornblende granite
GN6 Quartz porphyry
GN7 Biotite granite
M. S. Buchanan (2b)

GURAKA
GK1 Hedenbergite syenite, aenigmatite Ca-Na amphibole syenite
R. R. E. Jacobson and W. N. MacLeod (2a)

IMORI
Not mapped in detail
IM1 Arfvedsonite granite
C. Raeburn, A. D. N. Bain and W. Russ, Geol. Surv.Nig. Bull.No.11

JARAWA
JR1 Hornblende biotite granite
JN2 Biotite granite
JN3 Biotite granite
JN4 Biotite microgranite
N. G. Berridge (2b)

JERE-SANGA
JS1 Pre-caldera agglomerates, ash fall tuffs and crystal-poor ignimbrites
JS2 Intra-caldera crystal-rich ignimbrites
JS3 Quartz porphyry
JS4 Hornblende biotite quartz monzonite, monzonite porphyry
JS5 Biotite granite
JS6 Arfvedsonite granite
JS7 Riebeckite annite granite
JS8 Riebeckite annite granite
W. N. MacLeod (2b)

*** JOS-BUKURU**
JB1 Intra-caldera crystal-rich ignimbrites
JB2 Granite porphyry
JB3 Hornblende biotite granite
JB4 Quartz porphyry
JB5 Biotite granite
JB6 Biotite granite
JB7 Biotite granite
JB8 Biotite granite locally zinnwaldite albite granite
JB9 Biotite granite
JB10 Fayalite hornblende granite
JB11 Biotite granite
JB12 Biotite granite
JB13 Biotite granite
JB14 Biotite microgranite
W. N. MacLeod and N. G. Berridge (2b) ATMN (3) Bisichi-Jantar (3)

JUNGURU
J1 Arfvedsonite granite
J2 Biotite granite
M. S. Buchanan (2b)

KAGORO
KG1 Hornblende biotite granite
KG2 Fayalite hornblende granite
KG3 Biotite microgranite
M. S. Buchanan (2b), D. C. Turner (1)

KERKU
Not mapped in detail
KK1 Syenite
KK2 Arfvedsonite granite
C. Raeburn, A. D. N. Bain and W. Russ, Geol. Surv. Nig. Bull. No.11

KIGOM
KM1 Ferrorichterite granite
KM2 Riebeckite annite granite
KM3 Arfvedsonite aegirine granite
KM4 Aegirine microgranite
M. S. Buchanan (2b)

KILA-WARJI
KW1 Pre-caldera ignimbrites with minor aphyric trachytes
KW2 Intra-caldera porphyritic trachyandesite and trachyte
KW3 Hornblende biotite granite
KW4 Post-caldera trachytic plugs
KW5 Granite porphyry
KW6 Granite porphyry
KW7 Arfvedsonite granite
KW8 Granite porphyry
KW9 Aegirine granite
KW10 Hornblende syenite
KW11 Agglomerate
KW12 Intra-caldera crystal-rich ignimbrites and quartz porphyries
KW13 Hedenbergite, Ca-Na amphibole quartz syenite porphyry
KW14 Aegirine arfvedsonite granite
KW15 Granite porphyry
KW16 Hornblende biotite granite
D. C Turner in J. Geol. Soc. Lond. 1968

KOFAI
KF1 Gabbro, dolerite and net-veined acid/basic assemblage
KF2 Granite porphyry
KF3 Biotite granite
KF4 Biotite microgranite
M. S. Buchanan (2b)

KUDARU
K1 Quartz porphyry and microgranite
K2 Quartz porphyry
K3 Fayalite hedenbergite granite
K4 Arfvedsonite granite
K5 Biotite granite
A. D. N. Bain in J. Geol. Soc. Lond. 1934

KUNKUR
KN1 Agglomerates, ash fall tuffs and pre-caldera ignimbrites
W. N. MacLeod (2b)

KWANDONKAYA
KD1 Fayalite hornblende granite
KD2 Hornblende biotite granite
KD3 Biotite granite
KD4 Biotite granite
KD5 Porphyritic biotite granite
KD6 Biotite microgranite
M. S. Buchanan (2b)

LANGTANG
L1 Alkali-feldspar syenite
L2 Granite porphyry
L3 Arfvedsonite granite
D. C. Turner (1)

MADA
Not mapped in detail
MD1 Granite porphyry
MD2 Biotite granite with marginal granite porphyry
MD3 Biotite granite
MD4 Probably biotite granite
Granite Research Group (1)

MATSENA
M1 Ash fall tuff, lithic tuff, ignimbrites and comendite
M2 Quartz porphyry
M3 Arfvedsonite granite occasionally porphyritic sometimes with astrophyllite and/or aegirine
D. C. Turner in Records Geol. Surv., Nig. 8 1974

MIANGO
MN1 Granite porphyry
MN2 Biotite granite
W. N. MacLeod (2b)

NINGI-BURRA
IN1 Basalts and trachybasalts
IN2 Trachyandesites and trachytes
IN3 Porphyritic trachyandesites and trachytes
IN4 Ash fall tuffs and agglomerates
IN5 Vertically banded crystal-rich ignimbrites
IN6 Intra-caldera ignimbrites
IN7 Hornblende biotite granite, quartz syenite
IN8 Aegirine arfvedsonite granite
2N1 Basalts and trachybasalts
2N2 Ash fall tuffs and agglomerates
2N3 Pre-caldera ignimbrites
2N4 Intra-caldera ignimbrites
2N5 Quartz porphyry
2N6 Quartz porphyry
2N7 Biotite granite
3N1 Granite porphyry
4N1 Intra-caldera ignimbrites
4N2 Granophyre with biotite
4N3 Granophyre
5N1 Intra-caldera ignimbrites
5N2 Granophyre
5N3 Caldera lake sandstones and siltstones
5N4 Granite porphyry
6N1 Basalts and trachybasalts
6N2 Ash fall tuffs and agglomerates
6N3 Pre-caldera ignimbrites
6N4 Intra-caldera comenditic ignimbrites
6N5 Quartz porphyry
6N6 Biotite granite
6N7 Ferrorichterite syenite
6N8 Aegirine arfvedsonite granite
6N9 Biotite granite
D. C. Turner and P. Bowden in J. Geol. Soc. Lond 1979

NINGISHI
NN1 Fayalite hornblende granite
NN2 Biotite granite
NN3 Biotite granite
M. S. Buchanan (2b)

NOK
Not mapped in detail
NK1 Biotite granite
C. Raeburn (2c), Geol. Surv Nig. Bull. No.5

***RIRIWAI**
R1 Pre-caldera agglomerates, ash fall tuffs, crystal-poor ignimbrites and minor comenditic ignimbrites
R2 Syenite
R3 Quartz porphyry
R4 Granite porphyry
R5 Aegirine arfvedsonite granite and porphyry
R6 Biotite granite
R7 Biotite granite
R8 Arfvedsonite albite granite
R. R. E. Jacobson (2a), (1), Gold and Base (3) and Nigerian Mining Corporation

RISHIWA
Not mapped in detail
RS1 Mainly net-veined acid/basic assemblage
RS2 Riebeckite annite granite
RS3 Mainly arfvedsonite granite
C. Raeburn, A. D. N. Bain and W. Russ, Geol. Surv. Nig. Bull.No.11

ROPP
RP1 Ignimbrites and breccias
RP2 Quartz porphyry
RP3 Granite porphyry
RP4 Biotite granite
RP5 Biotite granite
RP6 Biotite granite
RP7 Biotite granite
RP8 Riebeckite annite granite
RP9 Arfvedsonite albite granite
RP10 Riebeckite annite granite porphyry
RP11 Granite porphyry
RP12 Biotite granite
RP13 Biotite microgranite
R. Black (2b), A.T.M.N. (3), Ex-Lands (3)

RUKUBA
RK1 Hornblende biotite granite
RK2 Biotite granite
RK3 Biotite granite
RK4 Biotite granite
RK5 Biotite granite
W. N. MacLeod (2b)

***SAIYA-SHOKOBO**
SS1 Dolerite, gabbro, net-veined acid/basic assemblage
SS2 Alkali-feldspar syenite
SS3 Pre-caldera agglomerates and ignimbrites
SS3' Basalt
SS4 Quartz porphyry
SS5 Granite porphyry
SS6 Mainly crystal-rich comenditic ignimbrites
SS7 Arfvedsonite granite porpphyry
SS8 Arfvedsonite granite
SS9 Biotite granite
M. S. Buchanan (2b),(1)

SARA-FIER
1SF1 Pre-caldera and intra-caldera agglomerates, ignimbrites and basaltic lavas
1SF2 Granite porphyry
1SF3 Hornblende biotite granite
1SF4 Biotite granite
2SF1 Hedenbergite hornblende granite
2SF2 Hornblende biotite granite
2SF3 Arfvedsonite granite
2SF4 Hornblende biotite granite
2SF5 Biotite granite
2SF6 Biotite microgranite
3SF1 Hornblende biotite granite
3SF2 Hornblende biotite granite
3SF3 Biotite granite
3SF4 Biotite granite
4SF1 Net-veined acid/basic assemblage
4SF2 Granite porphyry
4SF3 Fayalite hedenbergite granite
5SF1 Net-veined acid/basic assemblage
5SF2 Syenite, quartz syenite
5SF3 Biotite granite
5SF4 Hornblende biotite granite
5SF5 Fayalite hornblende granite
5SF6 Hornblende quartz syenite porphyry
D. C. Turner in J. Geol. Soc. Lond. 1963

SHA-KALERI
1SK1 Pre-caldera agglomerates, ash fall tuffs and crystal-poor ignimbrites
1SK2 Intra-caldera crystal-rich ignimbrites
1SK3 Granite porphyry
1SK4 Biotite granite
1SK5 Biotite granite
1SK6 Hornblende hornblende granite
1SK7 Granite porphyry
1SK8 Biotite granite
1SK9 Hornblende biotite granite
1SK10 Hornblende quartz syenite
1SK11 Hornblende quartz syenite
1SK12 Biotite granite
1SK13 Hornblende arfvedsonite granite and pegmatite
1SK14 Granite porphyry
1SK15 Biotite granite
2SK1 Hornblende biotite granite
2SK2 Biotite microgranite
3SK1 Biotite granite
3SK2 Biotite granite / ? Basement
3SK3 Granite porphyry
3SK4 Biotite granite
W. N. MacLeod (2b), D. King (3)

SHARWAI
SH1 Biotite granite
W. N. MacLeod (2b)

SHERE
SR1 Monzogabbro
SR2 Fayalite ferrohedenbergite granite
SR3 Biotite granite
SR4 Aegirine aegirine granite
SR5 Riebeckite annite granite
SR6 Arfvedsonite albite granite
SR7 Granite porphyry
N. G. Berridge (2b)

SHIRA
S1 Granite porphyry
S2 Ferrorichterite aenigmatite quartz syenite
S3 Aegirine arfvedsonite granite
S4 Ferrorichterite granite
S5 Ferrorichterite aenigmatite syenite and aegirine quartz syenite
S6 Biotite granite
J. N. Bennett (1), M. Barrière (1)

SHONA
SN1 Biotite granite
M. S. Buchanan (2b), R. R. E. Jacobson and E. H. Jacques (2c)

SUTUMI
ST1 Pre-caldera agglomerates, ash fall tuffs, ignimbrites and breccias
ST2 Hornblende biotite granite
ST3 Biotite granite
M. S. Buchanan (2b)

***TIBCHI**
TY1 and TY1' Ash fall tuffs and rhyolitic lavas with minor basalts and trachytes
TY2 Varied porcelanitic rocks with interbedded basalts and trachytes
TY3 Crystal-rich ignimbrites
TY4 Granite porphyry
TY5 Granite porphyry
TY6 Biotite granite
TY7 Biotite microgranite
TY8 Metasomatic modifications of biotite granite
E. C. Bix (1)

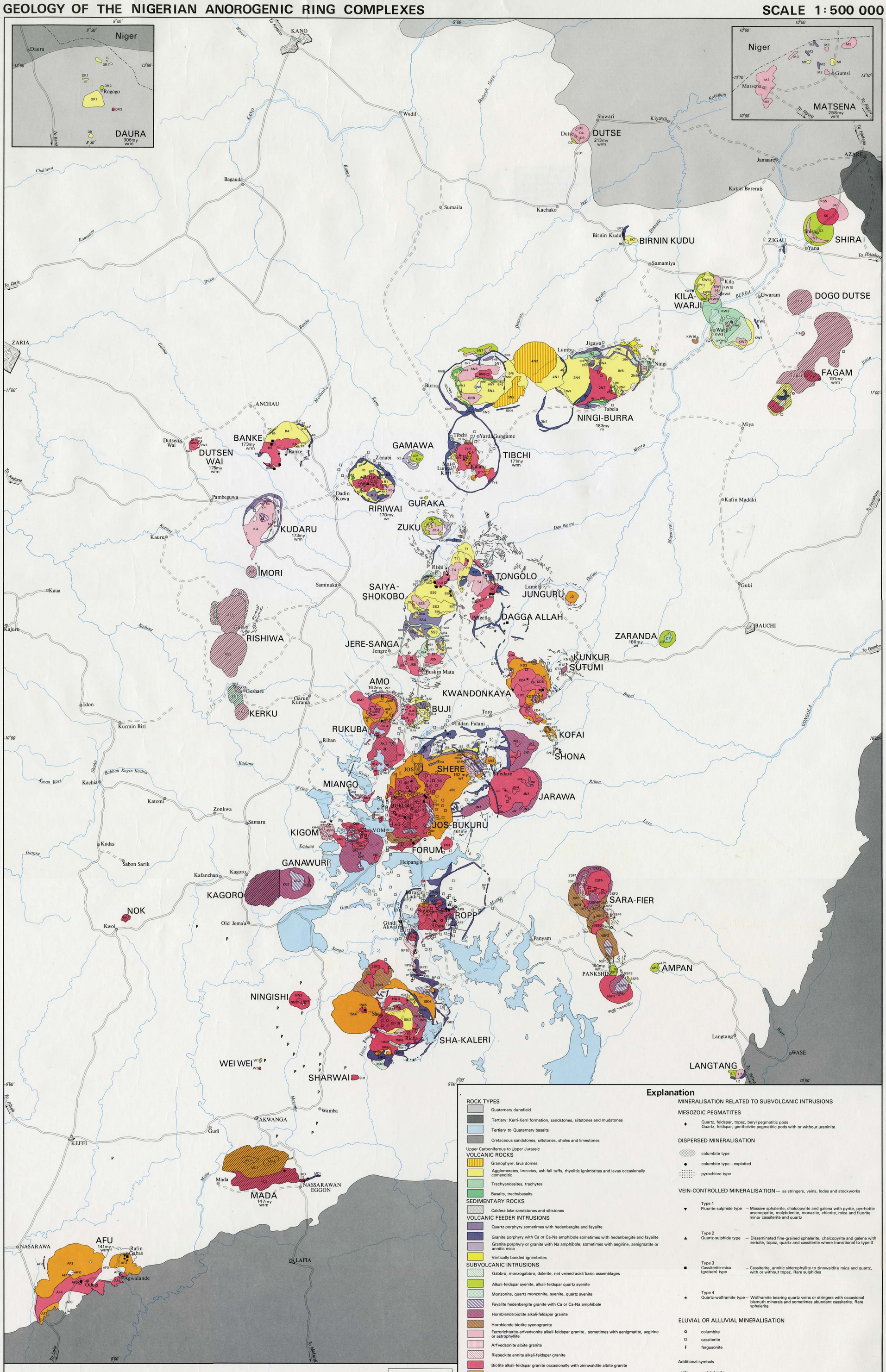
TONGOLO
T1 Pre-caldera crystal-poor ignimbrites
T2 Intra-caldera crystal-rich ignimbrites
T3 Granite porphyry
T4 Biotite granite
T5 Biotite granite
T6 Biotite granite
R. Black and M. S. Buchanan (2b), D. C. Turner (1)

WEI WEI
Not mapped in detail
W1 Mainly crystal-rich ignimbrites
W2 Probably biotite granite with marginal riebeckite annite granite
C. Raeburn (2c), Geol. Surv. Nig. Bull. No.5.

ZARANDA
Z1 Trachytes and minor ignimbrites
Z2 Hedenbergite Ca-Na amphibole syenite, aenigmatite quartz syenite with marginal arfvedsonite granite
D. C. Turner in Nig. J. Min. and Geol. 1971

ZUKU
ZK1 Pre-caldera agglomerates, ash fall tuffs and comenditic ignimbrites
ZK2 Ferroaugite syenite porphyry
ZK3 Arfvedsonite granite
ZK4 Aegirine granite
R. R. E. Jacobson, W. N. MacLeod and M. S. Buchanan (2a)

SOURCES
1. St. Andrews University Younger Granite Research Group
2. Geological Survey of Nigeria
   a.) Bulletin No. 33
   b.) Records 1961
   c.) Other maps and reports
3. Mining Company published or unpublished data
* Complexes enlarged with details of mineralisation



Explanation

ROCK TYPES

- Quaternary dunefield
- Tertiary: Kerri-Kerri formation, sandstones, siltstones and mudstones
- Tertiary to Quaternary basalts
- Cretaceous sandstones, siltstones, shales and limestones

Upper Carboniferous to Upper Jurassic

VOLCANIC ROCKS

- Granophyre: lava domes
- Agglomerates, breccias, ash fall tuffs, rhyolitic ignimbrites and lavas occasionally comenditic
- Trachyandesites, trachytes
- Basalts, trachybasalts

SEDIMENTARY ROCKS

- Caldera lake sandstones and siltstones

VOLCANIC FEEDER INTRUSIONS

- Quartz porphyry sometimes with hedenbergite and fayalite
- Granite porphyry with Ca or Ca-Na amphibole sometimes with hedenbergite and fayalite
- Granite porphyry or granite with Na amphibole, sometimes with aegirine, aenigmatite or annitic mica
- Vertically banded ignimbrites

SUBVOLCANIC INTRUSIONS

- Gabbro, monzogabbro, dolerite, net veined acid/basic assemblages
- Alkali-feldspar syenite, alkali-feldspar quartz syenite
- Monzonite, quartz monzonite, syenite, quartz syenite
- Fayalite hedenbergite granite with Ca or Ca-Na amphibole
- Hornblende biotite alkali-feldspar granite
- Hornblende biotite syenogranite
- Ferrorichterite-arfvedsonite alkali-feldspar granite, sometimes with aenigmatite, aegirine or astrophyllite
- Arfvedsonite albite granite
- Riebeckite annite alkali-feldspar granite
- Biotite alkali-feldspar granite occasionally with zinnwaldite albite granite
- Biotite syenogranite
- Complexes not mapped in detail
- Dykes and cone sheets of rhyolite, felsite and microgranite
- Dolerite dykes

Upper Precambrian to Lower Palaeozoic rocks

- P — Pegmatites with cassiterite, columbite, tantalite, beryl and tourmaline
- Basement meta-sedimentary and meta-igneous rocks with calc-alkaline intrusives

MINERALISATION RELATED TO SUBVOLCANIC INTRUSIONS

MESOZOIC PEGMATITES

- ♦ Quartz, feldspar, topaz, beryl pegmatitic pods
  Quartz, feldspar, genthelvite pegmatitic pods with or without uraninite

DISPERSED MINERALISATION

- columbite type
- ● columbite type—exploited
- pyrochlore type

VEIN-CONTROLLED MINERALISATION — as stringers, veins, lodes and stockworks

- Type 1 Fluorite-sulphide type — Massive sphalerite, chalcopyrite and galena with pyrite, pyrrhotite arsenopyrite, molybdenite, monazite, chlorite, mica and fluorite minor cassiterite and quartz
- ▲ Type 2 Quartz-sulphide type — Disseminated fine-grained sphalerite, chalcopyrite and galena with sericite, topaz, quartz and cassiterite where transitional to type 3
- ■ Type 3 Cassiterite-mica (greisen) type — Cassiterite, annitic siderophyllite to zinnwaldite mica and quartz, with or without topaz. Rare sulphides
- ★ Type 4 Quartz-wolframite type — Wolframite bearing quartz veins or stringers with occasional bismuth minerals and sometimes abundant cassiterite. Rare sphalerite

ELUVIAL OR ALLUVIAL MINERALISATION

- ○ columbite
- □ cassiterite
- F fergusonite

Additional symbols

- • Mo molybdenite
- • Ge genthelvite
- • U uraninite
- ------ lodes in the Ririwai and Tibchi complexes

Petrographic nomenclature in Explanation follows IUGS recommendations and AGI Glossary of Geology
Rb/Sr Age dates corrected to decay constant $\lambda = 1.42 \times 10^{-11} yr^{-1}$, wr — whole rock, m — mineral (feldspar, mica). Analytical error in range 2-4%.
Original Rb/Sr ages determined by O. van Breemen, J. Hutchinson and M. O. Rahaman at S.U.R.R.C. East Kilbride.

St. Andrews University Younger Granite Research Group 1973-1978
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