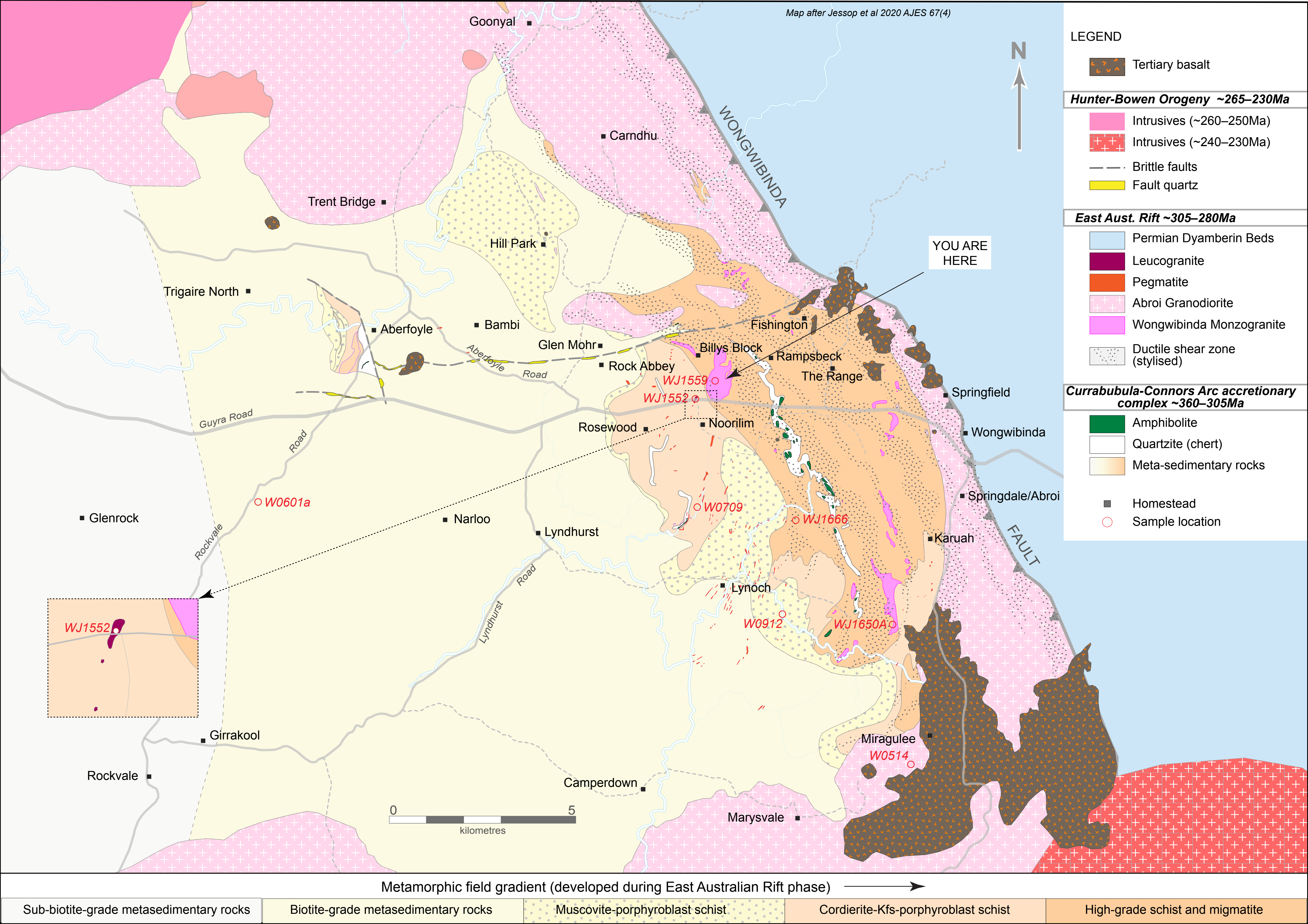

Map after Jessop et al 2020 AJES 67(4)
N
LEGEND
Tertiary basalt
Hunter-Bowen Orogeny ~265–230Ma
Intrusives (~260–250Ma)
Intrusives (~240–230Ma)
Brittle faults
Fault quartz
East Aust. Rift ~305–280Ma
Permian Dyamberin Beds
Leucogranite
Pegmatite
Abroi Granodiorite
Wongwibinda Monzogranite
Ductile shear zone (stylised)
Currabubula-Connors Arc accretionary complex ~360–305Ma
Amphibolite
Quartzite (chert)
Meta-sedimentary rocks
Homestead
Sample location
YOU ARE HERE
WONGWIBINDA
FAULT
Goonyal
Carndhu
Trent Bridge
Hill Park
Trigaire North
Aberfoyle
Bambi
Glen Mohr
Rock Abbey
Fishington
Billys Block
Rampsbeck
The Range
Springfield
Wongwibinda
Springdale/Abroi
Karuah
Noorilim
Rosewood
WJ1559
WJ1552
W0601a
W0709
WJ1666
W0912
WJ1650A
W0514
Glenrock
Narloo
Lyndhurst
Lynoch
Miragulee
Girrakool
Rockvale
Camperdown
Marysvale
Guyra Road
Aberfoyle Road
Rockvale Road
Lyndhurst Road
0
5
kilometres
Metamorphic field gradient (developed during East Australian Rift phase)
Sub-biotite-grade metasedimentary rocks
Biotite-grade metasedimentary rocks
Muscovite-porphyroblast schist
Cordierite-Kfs-porphyroblast schist
High-grade schist and migmatite

Wongwibinda Metamorphic Complex: a fluid & magma transfer zone

Metamorphism at Wongwibinda has changed trench-turbidites, deep-sea cherts and basalts of the Carboniferous accretionary complex into schists, migmatites, quartzites and amphibolites (see map overleaf). From west to east, grade increases from sub-biotite facies to migmatites and the following progression is noted:

1. Biotite (sometimes fine muscovite) emerge(s) in place of clay minerals, sericite and chlorite.
2. Biotite coarsens and porphyroblasts (then clumps of porphyroblasts of muscovite appear).
3. K-feldspar and cordierite porphyroblasts develop.
4. Almandine garnet bearing migmatites occur within a wide high strain zone that parallels the Wongwibinda Fault.
5. Quartzite horizons within the high-grade metasediments contain numerous amphibolite pods.

Deformation-assisted fluid and magma migration

The Wongwibinda Shear Zone formed during Early Permian extension (ca. 305–280 Ma) and was a major pathway for hydrothermal fluids and magmas.

Fluids migrating up the pathway progressed from aqueous metamorphic liquids to crustal-derived melts and finally mixed magmas of crustal and mantle melts. The advection of heat by these migrating fluids and melts caused metamorphism and gradually advanced partial melting of the metasedimentary crust to shallower levels.

Thermocalc modelling indicates that peak temperatures at the crustal level now exposed at Wongwibinda reached ~650–700°C with pressures between 3.5–4kbar (~10km depth).

Magmatic collapse structures (Bons, Geology 2008 36-11) present in the migmatites attest to previous higher volumes of melt that escaped. Biotite-rich bands mark sites of melt-rock interaction and diffuse pathways of melt migration through the migmatites.

Large volumes of magma stalled and crystallised at the exposed crustal level forming diverse felsic plutonic rocks.

ca. 290 Ma S-type Granitoids

- Two-mica Wongwibinda Monzogranite outcrops are intimately associated with the highest-grade migmatites.
- Biotite Abroi Granodiorite cuts the high strain migmatitic rocks.

The Abroi Granodiorite, Wongwibinda Monzogranite and an unnamed leucogranite epitomise the variety of magmas that migrated up the Wongwibinda Shear Zone. The leucogranite and Wongwibinda Monzogranite are near-pure crustal melts. The Abroi Granodiorite has isotopic evidence of mixing with ~30 % mantle-derived melts.

Mineral	Abroi Granodiorite	Wongwibinda Monzogranite	Leucogranite
Quartz	42%	37%	33%
K-feldspar	22%	11%	30%
Plagioclase	26%	20%	20%
Biotite	10%	20%	2%
Muscovite	-	13%	14%
$\delta^{18}O$	11.05	13.3	13.3
εSr @ 290 Ma	0.70575	0.70685	0.70624
εNd @ 290 Ma	-2.27	-1.93	-1.94