

VANADIUM

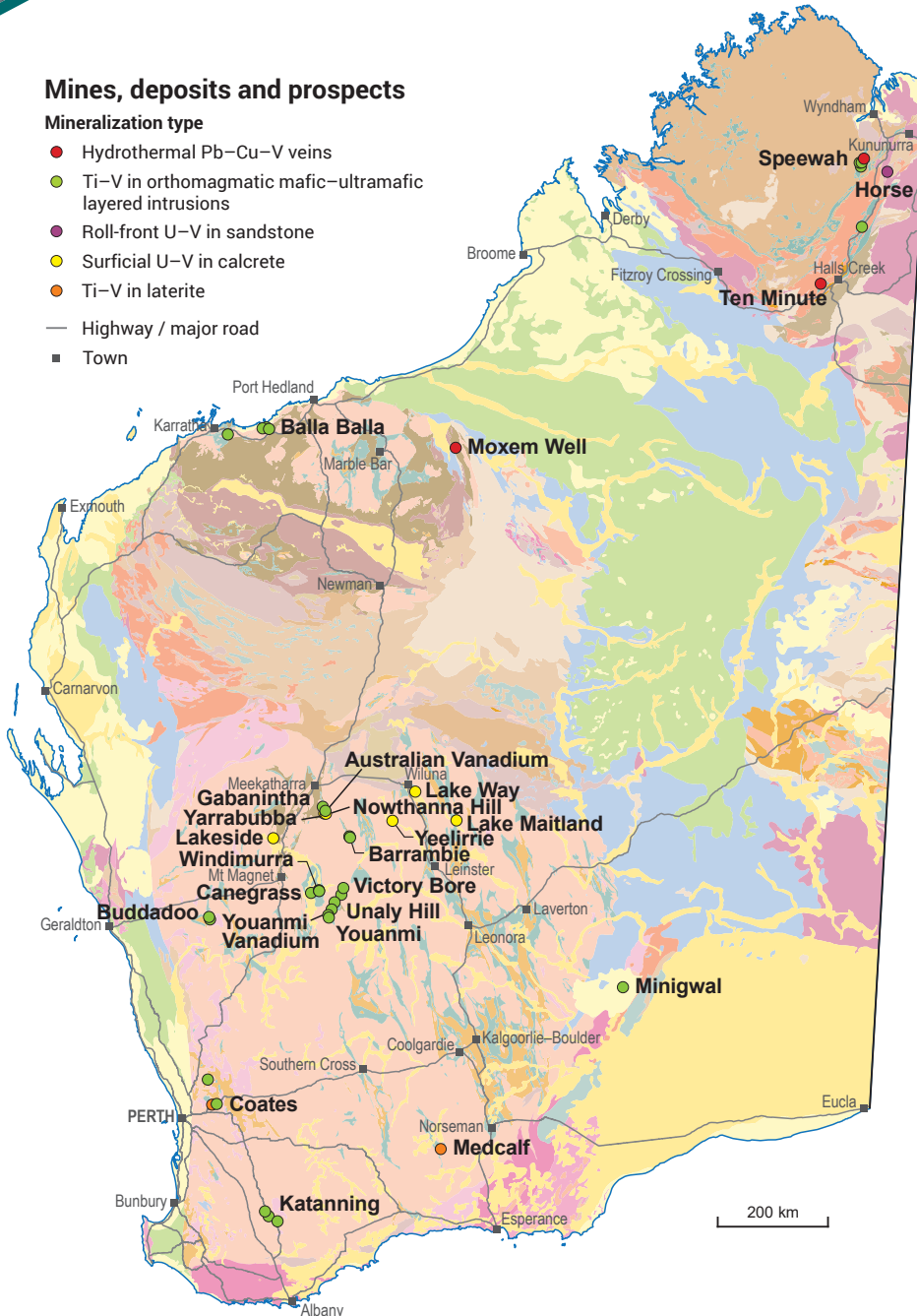
INVESTMENT OPPORTUNITIES

WORLD-CLASS RESOURCE PROVINCE | SECURE INVESTMENT LOCATION
WORLD-LEADING GEOSCIENTIFIC DATA | GLOBAL MINING SERVICES INDUSTRY

Mines, deposits and prospects

Mineralization type

- Hydrothermal Pb–Cu–V veins
- Ti–V in orthomagmatic mafic–ultramafic layered intrusions
- Roll-front U–V in sandstone
- Surficial U–V in calcrete
- Ti–V in laterite
- Highway / major road
- Town



\$1421 m*
Investment projects



5.0%†
Royalty rate



(2022–23 financial year)

* Includes projects planned, possible, committed or under construction as of October 2023

† 5% – concentrate, 2.5% – metal

Western Australia continues to grow into a global vanadium hub

- There is no current vanadium production in the state, but historical production in 2000–04 and 2012–14 was 14 100 t of V_2O_5 from Windimurra
- Uses for vanadium are primarily driven by steel consumption. Lately vanadium, along with other critical minerals, is being used for clean energy technologies vital to decarbonization efforts to reach net zero emissions. Vanadium-based redox flow batteries are a stationary energy storage technology suited to long-duration storage applications
- Western Australia substantial vanadium resources – 27 Mt of contained V_2O_5

Project stages

- Several projects are at the pre-feasibility, feasibility and scoping stages, including Gabanintha, Victory Bore, Speewah, Barrambie, Lake Way and Medcalf

Resources

- Updated Mineral Resource Estimates were released for the Canegrass Project (Viking Mines) of 145.8 Mt at 0.7% vanadium in November 2023 and Victory Bore Project (Surefire Resources) of 464.6 Mt at 0.29% vanadium in December 2023
- A Pre-Feasibility Study completed for Victory Bore had maiden Ore Reserves of 93.1 Mt at 0.35% vanadium

Recent project information

- Merger of Australian Vanadium and Technology Metals Australia consolidates two adjoining projects (Gabanintha) across one contiguous orebody, creating one of the largest vanadium development projects in the world with a >25-year mine life
- Australian Vanadium completed construction of a vanadium electrolyte manufacturing facility in Perth
- Surefire Resources developed a breakthrough pretreatment and leach process for vanadium extraction, achieving a 91% extraction of vanadium and 88% titanium directly from Vanadium Bore magnetite concentrate (mine life of 24 years)

Vanadium resources ranked by contained V₂O₅ (kt)

Mineral Resource Estimates reported in accordance with JORC (2012) unless otherwise stated

Project	Status	Owner	Resources (Mt)	Av. grade V ₂ O ₅ (%)	Contained V ₂ O ₅ (kt)	Resource date
Speewah	Pre-feasibility	Tivan	4711.0	0.30	14 180	01/04/2019
Balla Balla*	Feasibility	BBI Group	455.9	0.66	2 988	31/07/2009
Australian Vanadium Project	Feasibility	Australian Vanadium	239.0	0.73	1 748	01/11/2021
Victory Bore	Pre-feasibility	Surefire Resources	464.6	0.29	1 364	05/12/2023
Gabanintha	Feasibility	Technology Metals Australia (now owned by Australian Vanadium)	153.7	0.84	1 284	07/11/2022
Barrambie	Feasibility	Neometals	280.1	0.44	1 234	17/04/2018
Windimurra	Feasibility	Atlantic	209.7	0.50	1 045	30/11/2019
Canegrass	Exploration	Flinders Mines	145.8	0.70	1 014	20/11/2023
Buddadoo^	Exploration	CZR Resources	204.7	0.30	613	16/09/1991
Youanmi	Exploration	Diversity Resources	185.0	0.33	611	22/05/2019
Youanmi Vanadium	Scoping	Venus Metals Corporation, Legendre Bruce Robert	134.7	0.34	459	18/03/2019
Unaly Hill*	Exploration	Surefire Resources	86.2	0.42	362	21/11/2011
Medcalf – Bremer Range	Pre-feasibility	Audalia Resources	25.7	0.52	133	15/03/2022
Lake Way	Scoping	Toro Energy	69.3	0.03	23	21/10/2019
Lake Maitland	Scoping	Toro Energy	27.0	0.03	8	21/10/2019
Nowthanna Hill	Exploration	Australian Vanadium	3.6	0.03	1	31/05/2019

Resource estimates have been rounded

* Mineral Resources are JORC 2004 compliant

^ Mineral Resource is not JORC 2012 and is not CRIRSCO compliant

Spatial and resource estimates data sourced from WA Mines and Mineral Deposit database (MINEDEX)

 Ti-V in orthomagmatic mafic-ultramafic layered intrusions

 Surficial U-V in calcrete

Summary of vanadium uses

- Vanadium can be used to make steel alloys, for use in space vehicles, nuclear reactors, aircraft carriers, etc.
- Use in batteries – the vanadium flow battery (VFB) uses a different method of storing energy than Li-ion batteries. VFBs use a circulating electrolyte solution of vanadium pentoxide to store the charge in tanks, while Li-ion batteries store all the charge inside the battery cell itself. VFBs have lower energy density compared to Li-ion and have the ability to store a lot more total energy. VFBs are energy batteries and therefore very suitable for storing large amounts of energy for later use. Because flow batteries can cycle more often and to greater depths of discharge (100%), they have a longer life than Li-ion batteries, which eventually become less efficient when cycled too frequently. Vanadium flow batteries are safer than Li-ion since they are not prone to the thermal runaway known to occur with Li-ion batteries
- Vanadium can be utilized in ceramics as a pigment
- Vanadium pentoxide can be used as a catalyst in the manufacture of dyes and printing fabrics
- In the medical sphere, vanadium is used to treat a number of ailments, including diabetes, heart disease and high cholesterol. It has also been used in the cathodes of batteries for implantable cardioverter defibrillators



The Windimurra vanadium pit, looking south (Image courtesy T. Ivanic)

For more information

MINEDEX is a spatial and textual database of mining and exploration activity

MINEDEX www.demirs.wa.gov.au/minedex

GeoVIEW.WA is a free GIS-based spatial viewer

GeoVIEW.WA www.demirs.wa.gov.au/geoview

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