

**Ecandrewsite****(Zn, Fe<sup>2+</sup>, Mn<sup>2+</sup>)TiO<sub>3</sub>**

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**Crystal Data:** Hexagonal. *Point Group:*  $\bar{3}$ . As tabular crystals and grains, to 250  $\mu\text{m}$ .**Physical Properties:** Hardness = n.d. VHN = 500–600 (100 g load). D(meas.) = n.d. D(calc.) = 4.98–4.99**Optical Properties:** Opaque to translucent. *Color:* Dark brown to black; deep orange-brown in transmitted light; grayish white with a pinkish tint in reflected light. *Streak:* Dark brown to black. *Luster:* Submetallic.*Optical Class:* Uniaxial (+). *Pleochroism:* Weak. *Anisotropism:* Strong; greenish gray to dark brownish gray.R<sub>1</sub>–R<sub>2</sub>: (470) 17.2–19.9, (546) 17.2–19.7, (589) 17.0–19.6, (650) 16.8–19.2**Cell Data:** *Space Group:*  $R\bar{3}$ .  $a = 5.090(1)$   $c = 14.036(2)$   $Z = 6$ **X-ray Powder Pattern:** San Valentin mine, Spain.

2.73 (10), 2.53 (9), 1.71 (7), 2.23 (6), 1.87 (4), 3.69 (2), 1.502 (2)

**Chemistry:**

	(1)	(2)
TiO <sub>2</sub>	50.12	52.45
FeO	11.37	12.05
MnO	7.64	6.15
ZnO	30.42	29.35
Total	99.55	100.00

(1) Melbourne Rockwell mine, Australia; by electron microprobe, total Fe as FeO; corresponds to (Zn<sub>0.59</sub>Fe<sub>0.24</sub>Mn<sub>0.17</sub>)<sub>Σ=1.00</sub>Ti<sub>0.99</sub>O<sub>3</sub>. (2) San Valentin mine, Spain; by electron microprobe, total Fe as FeO; corresponds to (Zn<sub>0.56</sub>Fe<sub>0.26</sub>Mn<sub>0.13</sub>)<sub>Σ=0.95</sub>Ti<sub>1.02</sub>O<sub>3</sub>.**Polymorphism & Series:** Forms a series with ilmenite.**Mineral Group:** Ilmenite group.**Occurrence:** In quartz-rich metasediments of the amphibolite-granulite facies (Melbourne Rockwell mine, Australia); in a kyanite-bearing pelitic schist (Death Valley, California, USA).**Association:** Almandine-spessartine, ferroan gahnite, rutile (Melbourne Rockwell mine, Australia); zincian ilmenite (San Valentin mine, Spain); almandine, kyanite, zincian ilmenite, monazite, muscovite, quartz, chlorite, zircon, titanite (Death Valley, California, USA).**Distribution:** From the Melbourne Rockwell mine, Little Broken Hill, and the North mine, Broken Hill, New South Wales, Australia. In Spain, at the San Valentin mine, La Unión district, Sierra de Cartegena, Murcia Province. In the Black Mountains, Death Valley, Inyo Co., California, USA. From Fuzhou, Fujian Province, China.**Name:** Honors Ernest Clayton Andrews (1870–1948), New South Wales government geologist, who mapped the Broken Hill region.**Type Material:** Museum Victoria, Melbourne, Australia, M35700; Institute of Earth Sciences, Free University of Amsterdam, Amsterdam, The Netherlands.**References:** (1) Birch, W.D., E.A.J. Burke, V.J. Wall, and M.A. Etheridge (1988) Ecandrewsite, the zinc analogue of ilmenite, from Little Broken Hill, New South Wales, Australia, and the San Valentin Mine, Sierra de Cartegena, Spain. *Mineral. Mag.*, 52, 237–240. (2) (1989) *Amer. Mineral.*, 74, 501 (abs. ref. 1). (3) Whitney, D.L., M. Hirschmann, and M.G. Miller (1993) Zincian ilmenite-ecandrewsite from a pelitic schist, Death Valley, California, and the paragenesis of (Zn, Fe)TiO<sub>3</sub> solid solution in metamorphic rocks. *Can. Mineral.*, 31, 425–436.

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