PEZZOTTAITE

$\mathrm{Cs(Be_2Li)Al_2Si_6O_{18}}$

A SPECTACULAR NEW BERYL-GROUP MINERAL FROM THE SAKAVALANA PEGMATITE, FIANARANTSOA PROVINCE, MADAGASCAR

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ABSTRACT

Pezzottaite is a new mineral from the Sakavalana pegmatite, located 25 km south of the village of Mandosonoro, southwest of the town of Antsirabe, 140 km southwest of Ambatofinandrahana, in Fianarantsoa province, central Madagascar. It usually occurs as isolated crystals that can have three distinct habits: (1) irregularly shaped flat masses that fill cavities between "cleavelandite", quartz and tourmaline; (2) subhedral-to-euhedral hexagonal tabular crystals up to 10 cm in diameter; and (3) small flat to equant to elongated crystals attached to faces of large tourmaline crystals. The form {001} is dominant, with minor {100} and {101}; no twinning was observed. Pezzottaite is moderate red (Munsell #15) to pink, with moderate dichroism in polarized light in hand specimen: ω = pink-orange and ε = purplish pink to pinkish purple. The streak is colorless to white, crystals are transparent to translucent with a vitreous luster and no observable fluorescence in long- and short-wave ultraviolet light. Crystals are brittle with both conchoidal and irregular fracture, have an imperfect cleavage parallel to {001}, and no observable parting. Mohs hardness is 8, the observed density is 2.97–3.14 g/cm^3 and the calculated density is 3.06 g/cm^3. Pezzottaite is uniaxial negative with $\varepsilon = 1.601$–1.611 and $\omega = 1.612$–1.620, depending on Cs content. In transmitted plane-polarized light, it is strongly pleochroic, orange-red $\|\varepsilon$ and purple-violet $\|\omega$.

Pezzottaite is rhombohedral, space group *R*3*c*, with the following unit-cell parameters refined from X-ray powder-diffraction data: *a* 15.946(4), *c* 27.803(8) Å, *V* 6122(2) Å^3, Z = 18. The ten strongest lines in the X-ray powder-diffraction pattern are as follows: *d* (Å), *I*, (*hkl*): 3.271, 100, (036); 2.871, 52, $(\bar{1}53)$; 3.027, 41, $(\bar{1}46)$; 3.09, 29, $(\bar{1}50)$; 2.215, 14, $(\bar{2}70)$; 1.636, 14, (0.6.12); 2.229, 12, $(\bar{1}2.12)$; 1.749, 12, $(\bar{3}6.12)$; 1.743, 12, $(\bar{3}90)$; 1.518, 11, $(\bar{3}99)$. Chemical analysis by electron microprobe and ICP (Li) gave SiO_2 55.55, Al_2O_3 16.00, Sc_2O_3 0.03, MnO 0.04, Na_2O 0.19, K_2O 0.04, Rb_2O 0.64, Cs_2O 16.12, Li_2O 2.16, BeO_{calc} 7.95, H_2O 0.28, sum 99.00 wt.%, where the amount of H_2O was determined by crystal-structure analysis. The resulting empirical formula, calculated on the basis of 18 structural O atoms, is $(Cs_{0.74}Rb_{0.04}K_{0.01}Na_{0.04})_{\Sigma 0.83}(Be_{2.06}Li_{0.94})Al_{2.04}Si_{6.00}O_{18}\text{-}(H_2O)_{0.10}$. Chemical analysis by LA-ICP-MS gave SiO_2 54.58, TiO_2 0.01, Al_2O_3 16.88, FeO 0.02, MnO 0.02, CaO 0.22, Na_2O 0.46, K_2O 0.14, Rb_2O 0.44, Cs_2O 18.23, Li_2O 2.12, BeO 8.14 sum 101.26 wt.%. The resulting empirical formula, calculated on the basis of 18 structural O atoms, is $(Cs_{0.84}Rb_{0.03}K_{0.02}Na_{0.10})_{\Sigma 0.98}(Be_{2.10}Li_{0.92})_{\Sigma 3.02}Al_{2.00}(Si_{5.86}Al_{0.14})O_{18}$. The end-member formula of pezzottaite is $Cs(Be_2Li)Al_2Si_6O_{18}$. The mineral is named for Dr. Federico Pezzotta of the Museo Civico, Milano, Italy, for his major role in characterizing the granitic pegmatites of Madagascar. The new mineral and mineral name have been approved by the Commission of New Minerals and Mineral Names of the International Mineralogical Association (2003-022). Pezzottaite is related to the minerals of the beryl group, but differs in having essential Cs and a superstructure that arises from ordering of Be and Li in tetrahedral coordination.

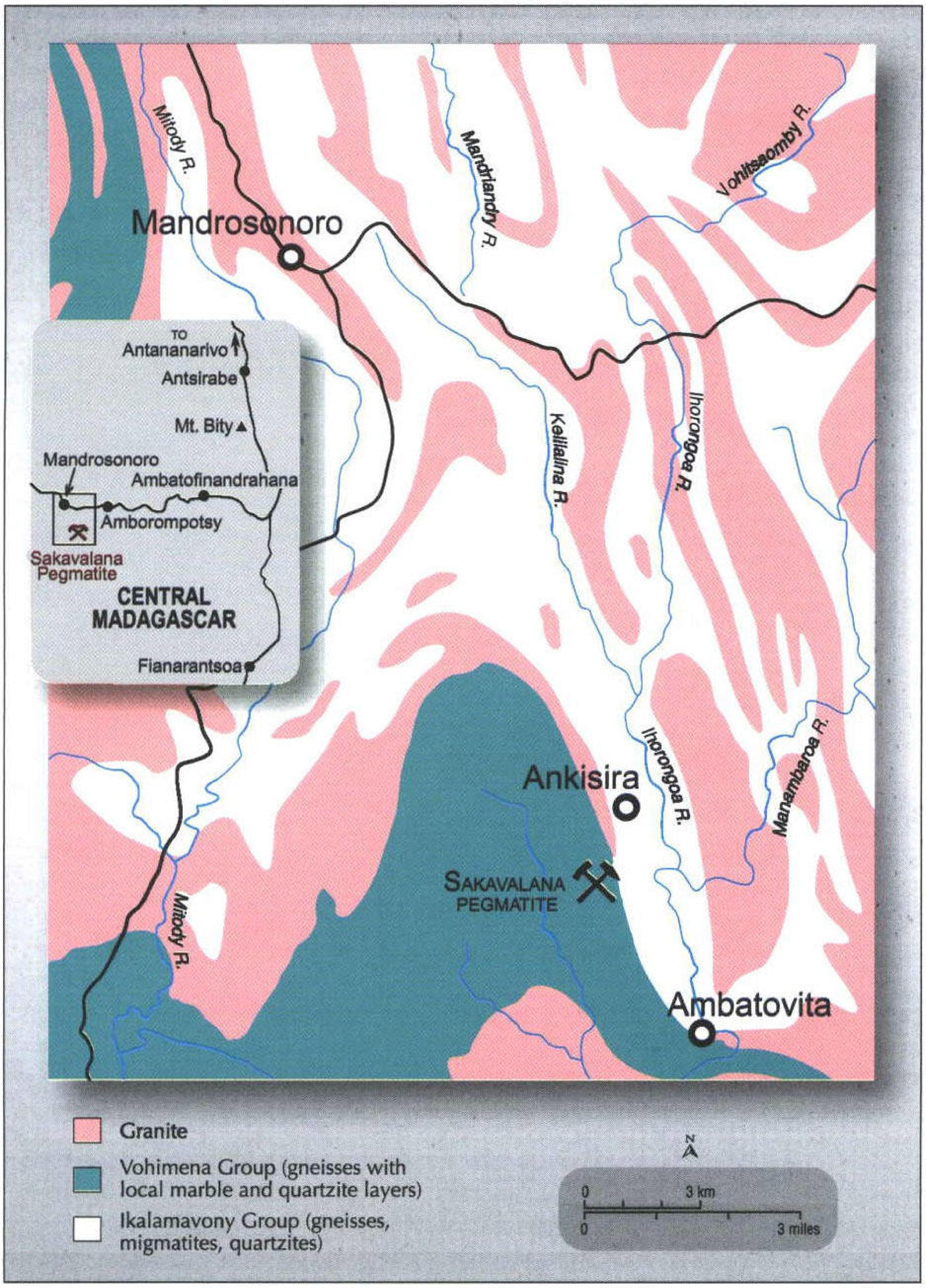

Figure 1. **Central Madagascar, showing the location of the towns of Antsirabe, Ambatofinandrahana and Mandrosonoro in relation to the pezzottaite type locality.**

INTRODUCTION

One of the most exciting mineral discoveries offered at the 2003 Tucson Gem and Mineral Show was the "red beryl," "raspberyl" or "hot pink-red beryl" displayed by many dealers. Rumors circulated as to the chemical composition of these very attractive crystals and whether or not they represented a new mineral species. The tabular habit, pink color and high refractive index suggested that this material is enriched in Cs, and this was confirmed by recent publications (Simmons *et al.*, 2003; Laurs *et al.*, 2003; Hänni and Krzemnicki, 2003; Abduriyim and Kitawaki, 2003; Warin and Jacques, 2003). Subsequent chemical and crystallographic examination showed that it is indeed a new mineral, and the formal description is presented here. The new mineral and mineral name, *pezzottaite* (pronounced "pets-aw′-tuh-ite"), have been approved by the Commission on New Minerals and Mineral Names, International Mineralogical Association. Type material is deposited in the Smithsonian Institution, Washington, DC, in the Canadian Museum of Nature, Ottawa, Ontario, Canada, and in the Natural History Museum of Bern (NMBE-36990), Switzerland. Sample NMBE-36990 was used for ICPMS analysis and single-crystal structure refinement.

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Figure 2. **These rolling hills are typical of those seen in central Madagascar en route to the pezzottaite mine. Photograph by Brendan M. Laurs, GIA.**

LOCATION AND ACCESS

The Sakavalana pegmatite is located about 140 air-kilometers southwest of Antsirabe, in Fianarantsoa province, central Madagascar. In July 2003, one of the authors (BML) accompanied Dr. Federico Pezzotta (Museo Civico di Storia Naturale, Milan, Italy) on a reconnaissance visit to the mine. We were the first foreigners to visit since French mineral dealer Laurent Thomas went there in January 2003, shortly after the mineral was first discovered. The route follows paved roads from Antsirabe to Ambatofinandrahana (Fig. 1), a distance of approximately 160 km that required about 6 hours of driving time. From there, a rough dirt track runs approximately 140 km to the town of Mandrosonoro (Fig. 3), and then another 25 km to the mine. The four-wheel-drive track passes through grasslands (Fig. 2), rolling hills and mountainous terrain, and crosses two rivers. This drive ideally takes about 14 hours, but considerable delays can be expected due to breakdowns caused by the rough terrain. Note that the road is typically hazardous to impassible during the rainy season from December to April.

GEOLOGY

The Sakavalana granitic pegmatite is located in the northern part of the Ampandramaika-Malakialina pegmatite district (Pezzotta, 2001). This pegmatite is a sub-vertical dike about 4–6 m thick and over 200 m long, and is enriched in Li–Cs–Ta minerals and characterized by the typical "mixed" feature (LCT and NYF, Černý, 1991) of some Malagasy pegmatites (Pezzotta, 2001). The pegmatite is hosted in impure marbles of the Vohimena Formation belonging to a metasedimentary sequence of marbles and quartzitic gneiss of medium metamorphic grade. The pegmatite is very rich in K-feldspar and contains large elongated blades of black mica in the border zones. Adjacent to the core zone, blades of white mica and pink to purple lithian muscovite appear, together with locally abundant smoky quartz, platy "cleavelandite" albite, green "amazonite" microcline, and tourmaline. In addition to the minerals mentioned above, danburite occurs in cavities, accompanied by zircon, spessartine and Nb-Ta oxides.

OCCURRENCE

The Sakavalana pegmatite is situated on a low hill at 920 m above sea level, coordinates 20°44.8′ S and 46°04.5′ E. It is located a few kilometers northwest of the village of Ambatovita, and southwest of Ankisira (Fig. 1), both of which lie along the Manambaroa River. The mine consists of pits, shafts and open cuts that explore at least one steeply south-dipping pegmatite dike. Mining at this location began in the 1940's, in search of polychrome tourmaline for specimens, carving and gem use. However, pezzottaite was not found there until mid-November of 2002. At the time of the mine visit in July 2003, mining for pezzottaite (and tourmaline) was continuing, but at a slower pace than in earlier months.

The main discovery of pezzottaite occurred about 6 m below the surface, in a subvertical pegmatite that is about 4–6 m thick and more than 200 m long. Many fine crystals of pezzottaite were recovered from a single pocket containing mostly smoky quartz,

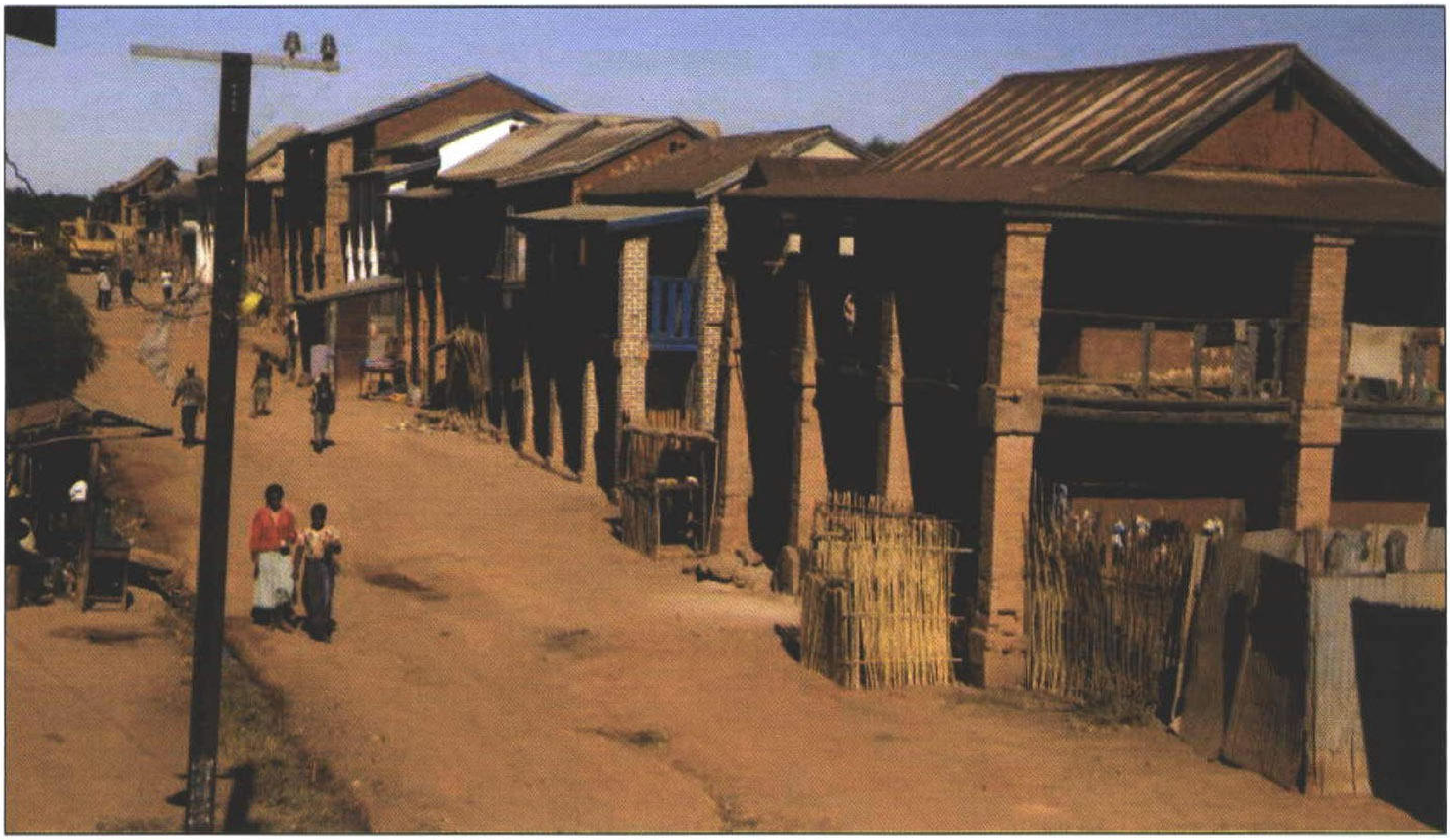

Figure 3. **The town of Mandrosonoro, located about 25 km north of the mine. Photograph by Brendan M. Laurs, GIA.**

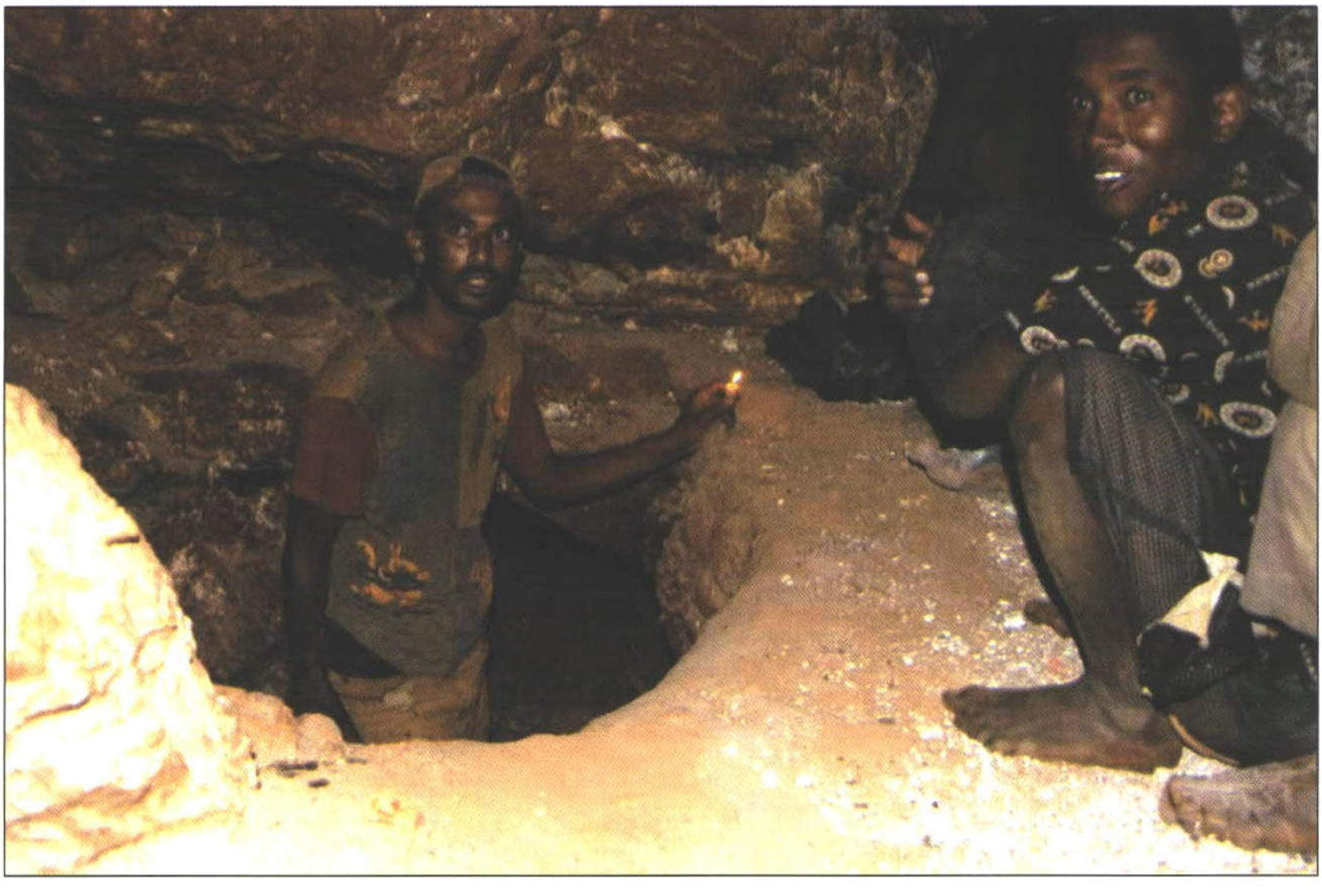

Figure 4. **Mining for pezzottaite is done by candlelight using simple hand tools; this zone contained numerous vugs. Photograph by Brendan M. Laurs, GIA.**

Figure 5. **Translucent crystal (right, 3 cm) and crystal aggregate (left) of pezzottaite. Stuart Wilensky specimens; Jeff Scovil photo.**

Figure 6. **Pezzottaite crystal, 6.2 cm across, displaying a prominent {001} pinacoid and smaller prism faces. Dudley Blauwett specimen; Jeff Scovil photo.**

Figure 7. **Tabular crystal of pezzottaite, 4.3 cm. Stuart Wilensky specimen; Jeff Scovil photo.**

amazonite and cleavelandite. In addition, multicolored tourmaline, pink-yellow-green spodumene, lithian muscovite and danburite occurred in this pocket which reportedly measured at least 1.2 x 3 x 3 m. Below this pocket was a zone containing numerous vugs with smaller crystals of pezzottaite. The pocket zone occurs within the core zone of the pegmatite, which consists of amazonite, smoky quartz, black tourmaline, lithian muscovite and cleavelandite.

Information provided by the miners, together with our observations of the surface and underground workings, indicate that all the pezzottaite produced up to that time came from a limited area within a single granitic pegmatite body. The majority of the gem-bearing zone has been mined out, and the remaining areas are difficult to work with the hand tools available (Fig 4). The total production of the pocket was about 700 kg of smoky-citrine quartz in crystals up to 50 kg, 280 kg of polychrome tourmaline crystals covered by a skin of black tourmaline (the three largest crystals were 15, 25, and 50 kg), 25 kg of gemmy spodumene (as well as some tens of kg of deeply corroded low quality spongy-crystals), and 40 kg of pezzottaite as crystals, fragments and masses (normally of a few grams, but in a few cases up to 100 g), plus many tens of kg of low-quality fragments and deeply corroded crystals (Federico Pezzotta, personal communication). Small amounts of pezzottaite were available at the mine, as well as elsewhere in Madagascar, but the material available there was of low quality.

PHYSICAL AND OPTICAL PROPERTIES

Pezzottaite occurs in three distinct habits: (1) irregularly shaped flat masses (up to 8 cm in diameter) that fill cavities between cleavelandite, quartz and tourmaline; (2) subhedral-to-euhedral hexagonal tabular crystals up to 10 cm across; (3) small (a few mm) flat to equant to elongated crystals attached to faces of large tourmaline crystals. The surface of the crystals varies from brilliant and adamantine (rare) to matte and slightly corroded (common). Type-2 crystals have occasionally been observed on matrix with quartz, amazonite, lithian muscovite, cleavelandite, and small prisms of black tourmaline (with a polychrome core). In some cases, crystals of type-3 are unusually elongated due to stacking of small tabular crystals. In well-developed crystals, the form {001} is dominant with minor {100} and {101}; no twinning was observed.

Larger crystals of pezzottaite tend to be hexagonal in outline and tabular on {001} (Fig. 7); the largest crystals of this type (Fig. 6) are up to approximately 10 cm in width. Crystals range from fairly opaque to translucent (Fig. 5), and sub-parallel aggregates of crystals are common. In translucent crystals, tubular channels containing water extend parallel to the *c*-axis, and impart chatoyancy to some crystals (Fig. 9) such that cat's-eye cabochons (Laurs

Figure 9. **Tabular crystal of pezzottaite, 6 cm across, viewed edge-on, showing chatoyancy associated with tubular fluid inclusions parallel to the *c*-axis. Dudley Blauwett specimen; Jeff Scovil photo.**

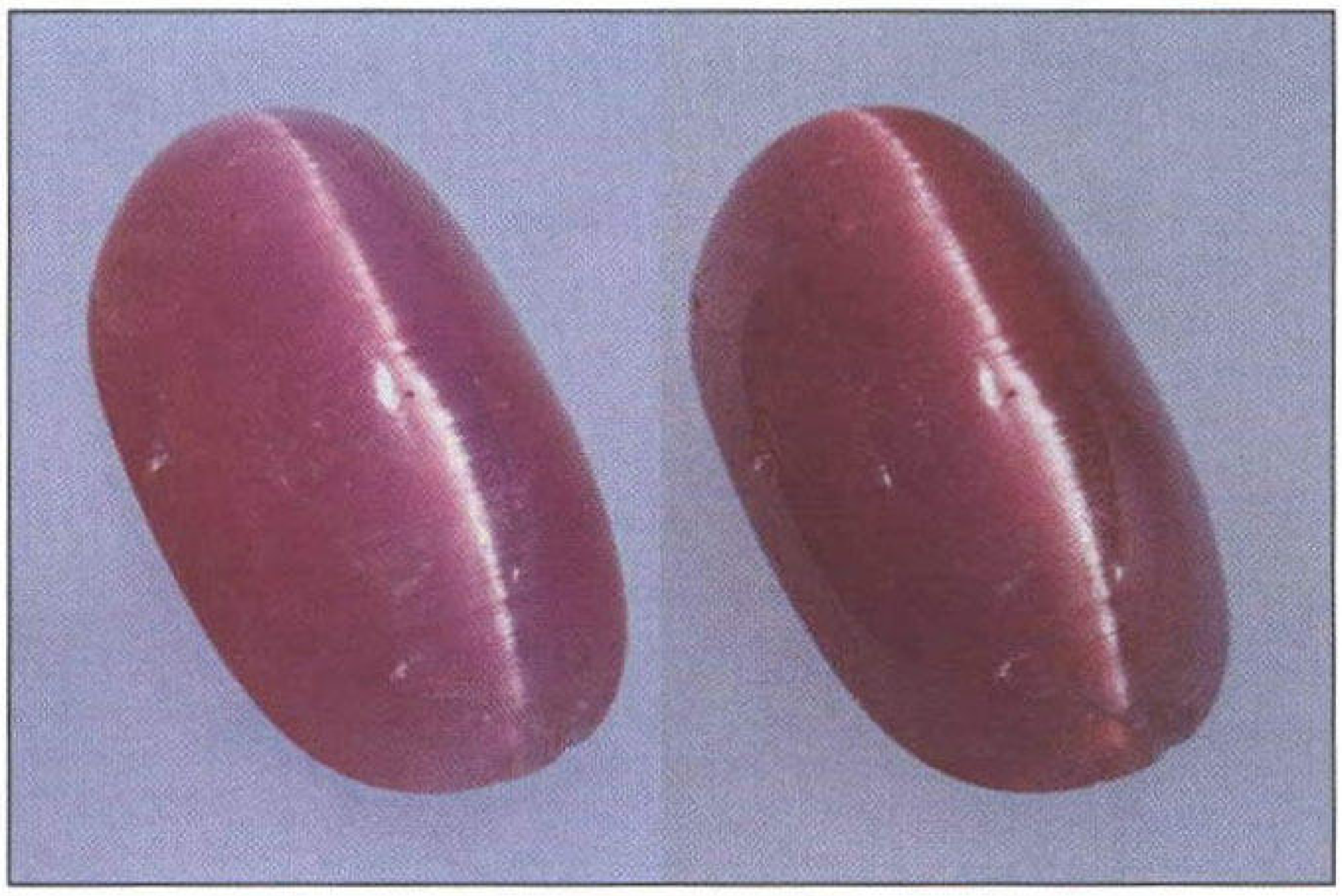

Figure 8. **Cat'e-eye cabachon of pezzottaite (8.78 ct.). The two views photographed through a polarizer (in orthogonal orientation) and show distinct dichroism. Bill Pinch collection; Maha Tannous photos.**

Figure 10. **Two faceted stones of pezzottaite. Photograph by Jeff Scovil; private collection.**

Figure 11. **Type-3 crystals of pezzottaite approximately 6 mm across, on amazonite. Federico Pezzotta collection; Roberto Appiani photo.**

et al., 2003) can be produced (Fig. 8). Transparent crystals can be faceted to produce very attractive cut stones (Fig. 10). Type-3 crystals (Fig. 11) exhibit a different habit from earlier-generation crystals. The {001} form is still present but far less dominant, and both pyramid {101} and prism {100} faces are of equal importance. Earlier-generation pezzottaite [type-1 and type-2] frequently shows corrosion by later hydrothermal fluids. For first-generation and second-generation crystals, this process is summarized in Figure 12. The characteristic pink-red (Munsell #15) color of pezzottaite is confined to the terminations of the crystal, and the remaining parts of the crystal are milky white or very pale pink. Corrosion selectively alters the white and pale-pink parts of the crystal, either leaving a spongy material on which microcrystals of albite form, or completely removing the central part of the crystal and leaving two separate pink gemmy terminations (Fig. 12A). One side of the termination consists of the morphology of the original crystal, and the other side consists of a series of steps and striations resulting from the corrosion process (Fig. 12A). Later-generation crystals [type-3, Fig. 12B] can also be corroded. The process involved (Fig. 12B) is similar to that depicted in Figure 12A, with the residual fragments of pezzottaite reflecting the habit of the original crystal (Fig. 13).

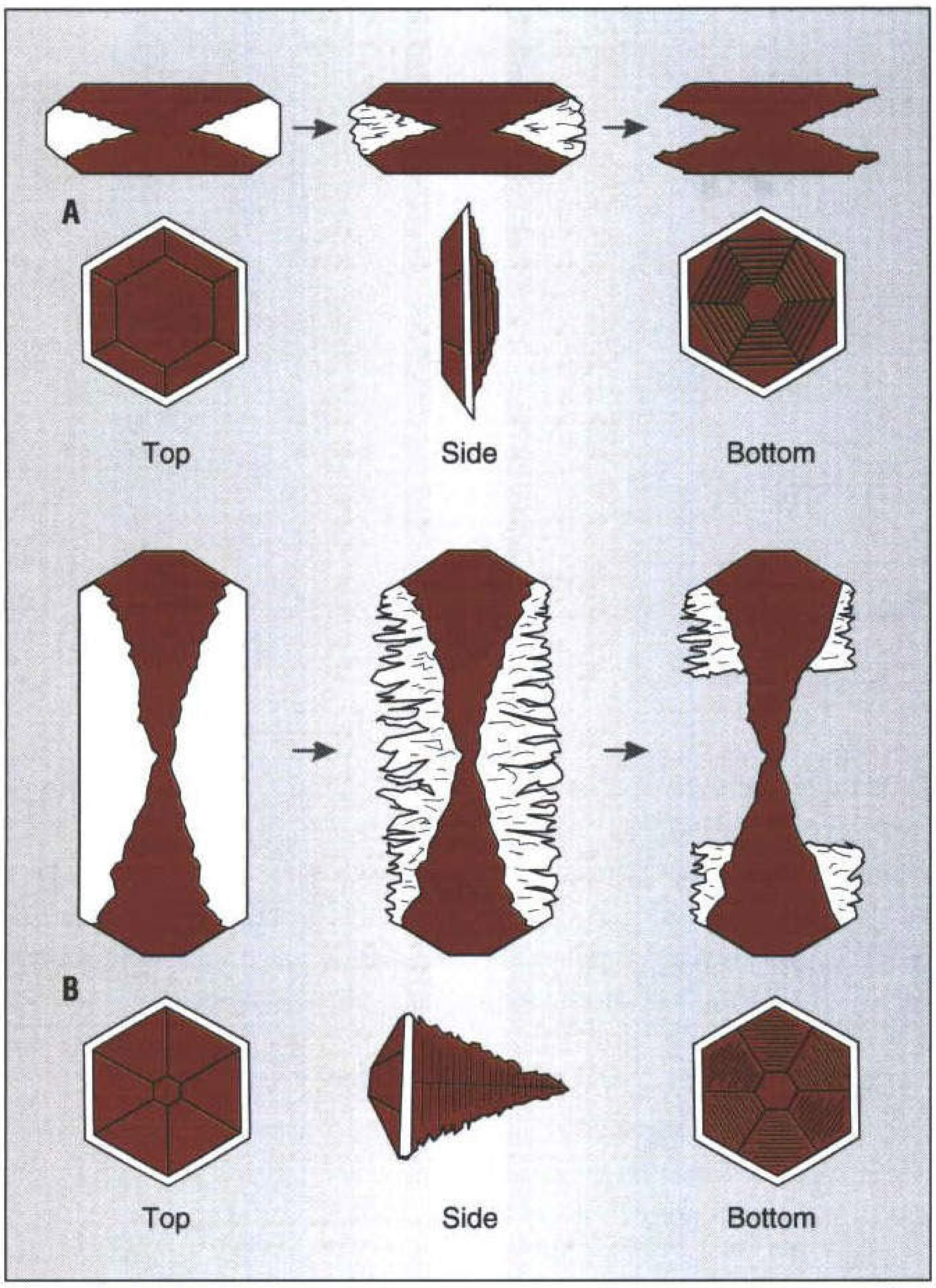

Figure 12. **Sketches of the color zoning and corrosion process of a typical type-1 pezzottaite crystal. (A) The bright pink-red color is confined to two zones at the terminations of the crystal. These terminations are gemmy whereas the other zones of the crystal are milky white or very pale pink. The corrosion process selectively alters the milky white zones of the crystal. Partial corrosion leaves a spongy material on which white microcrystals of albite can form. More commonly, the corrosion process completely dissolves the milky white parts of the crystal, leaving two separated colored zones. (B) The lower part of the figure represents the shape of the separate color zones: on one side, the crystal is terminated by the faces of the original crystal, whereas on the other side are steps and striations resulting from the corrosion process. Modified from information supplied by Federico Pezzotta.**

Figure 13. **A cone-shaped corroded crystal that represents the final product of the corrosion process for type-3 crystals (Fig. 12B). Loose crystals of this type are abundant in clay-filled cavities. Stuart Wilensky specimen; Jeff Scovil photo.**

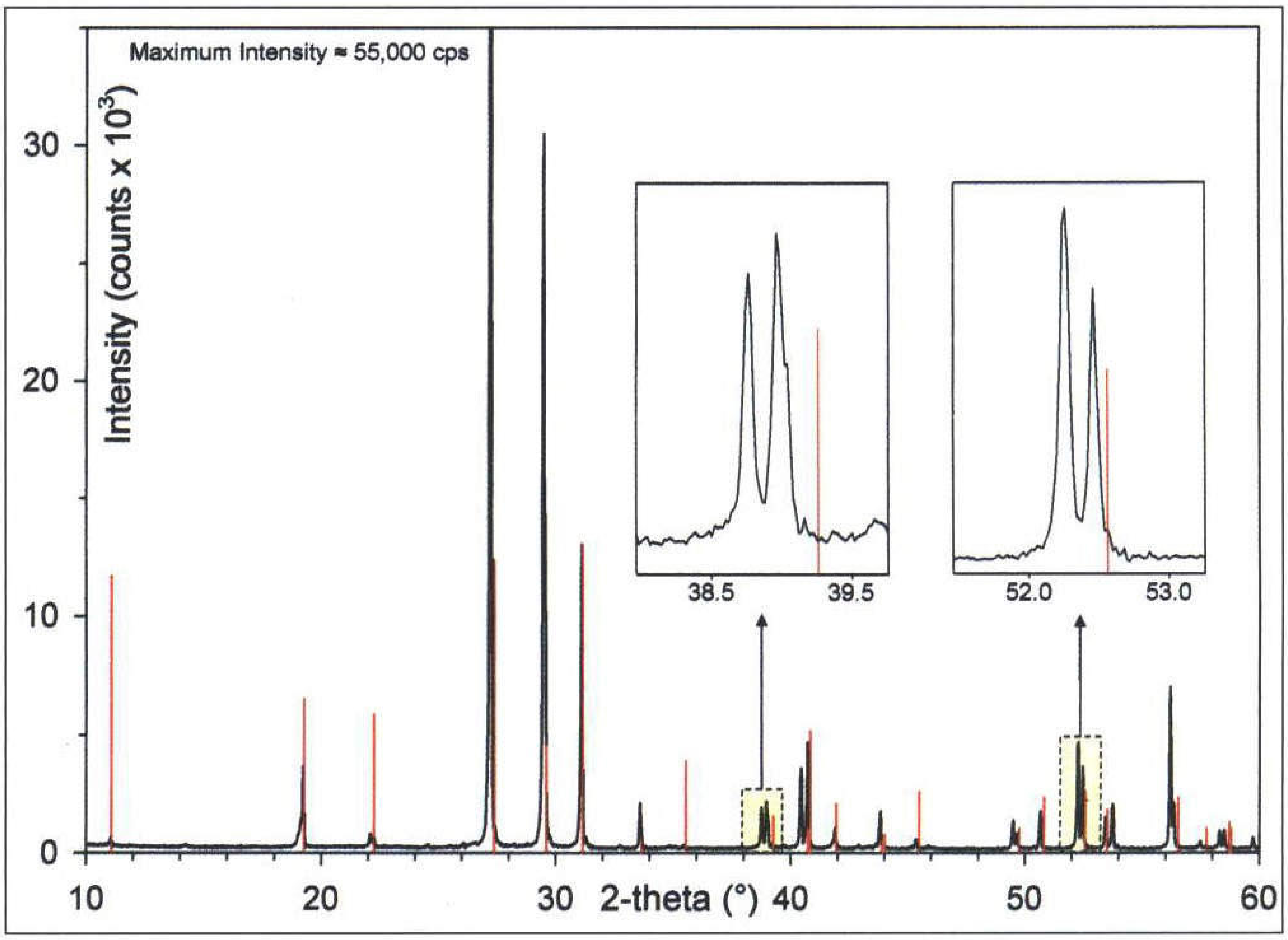

Figure 14. **Selected parts of the X-ray diffraction pattern of pezzottaite compared with the pattern (shown as red lines) of beryl. There are significant differences in the relative intensities of the peaks, particularly with regard to the *h*00 reflections that are strongly affected by the presence of Cs in the channels through the structure. Structurally equivalent peaks in pezzottaite and beryl lie at lower 2θ values in pezzottaite due to expansion of the structure caused by inclusion of Cs and substitution of Li for Be. Moreover, many of the peaks in pezzottaite occur as doublets relative to the analogous single lines in beryl (see insets in figure).**

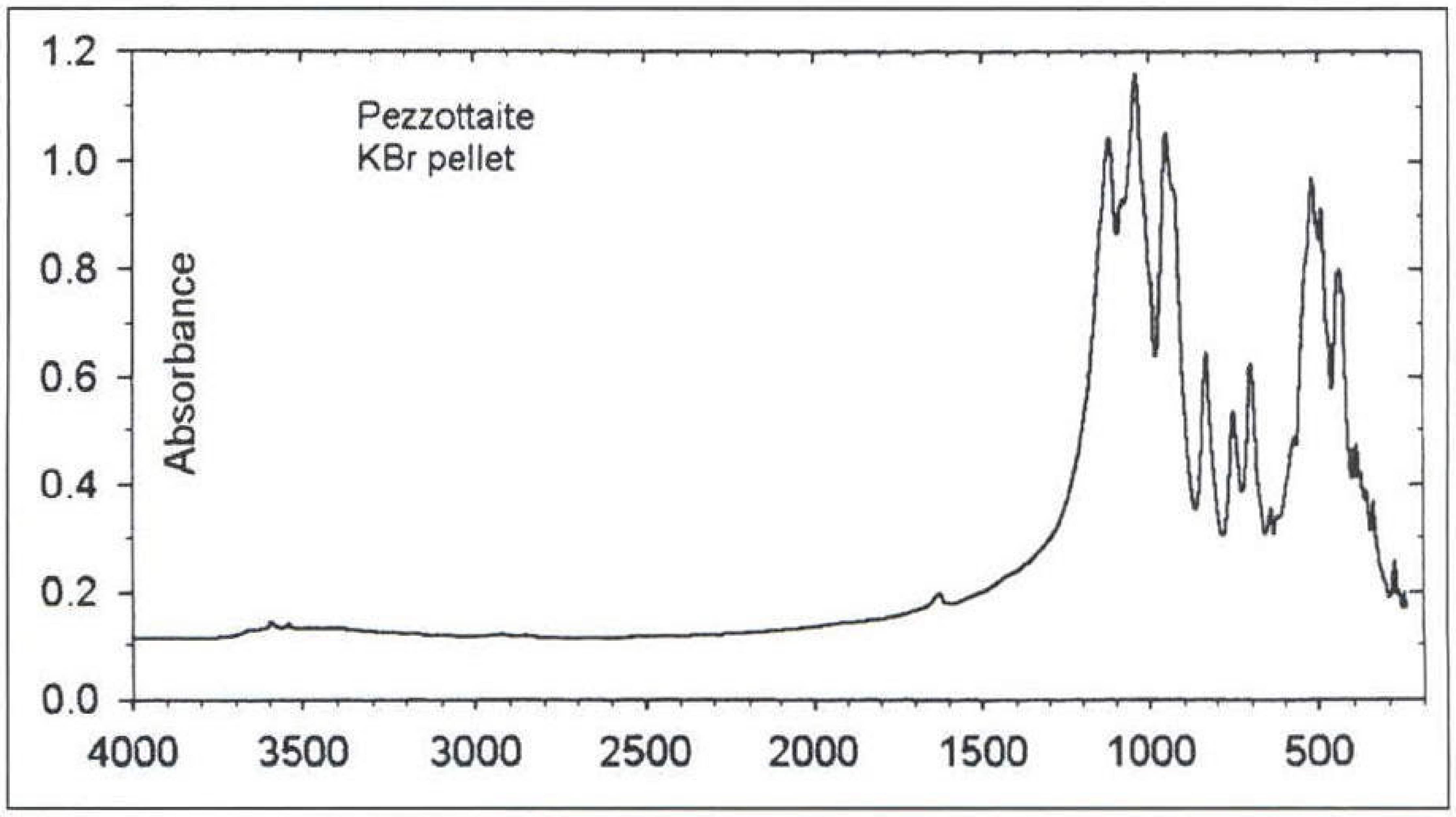

***Figure 15.* The infrared spectrum of pezzottaite powder in a KBr pellet.**

***Table 1.* Chemical composition (wt.%)* and formulae for pezzottaite.**

	low Cs	*high Cs*	*LA-ICP-MS*
SiO_2	57.59	55.55	54.58
Al_2O_3	16.22	16.00	16.88
FeO	0.00	0.00	0.02
MnO	0.09	0.04	0.02
CaO	0.00	0.00	0.22
Na_2O	0.32	0.19	0.46
K_2O	0.09	0.04	0.14
Rb_2O	0.85	0.64	0.44
Cs_2O	11.12	16.12	18.23
Li_2O	2.16	2.16	2.12
BeO	8.25 **	7.95 **	8.14
Σ	96.69	98.69	101.25
Si	6.06	6.00	5.86
Al	—	—	0.14
Al	2.01	2.04	2.00
Be	2.09	2.06	2.10
Li	0.91	0.94	0.92
Σ	3.00	3.00	3.02
Cs	0.50	0.74	0.83
Rb	0.06	0.04	0.03
Na	0.07	0.04	0.10
K	0.01	0.01	0.02
Ca	0.00	0.00	0.02
Σ	0.64	0.83	1.00

* Below detection limit: Mg, Ti, Fe, Ca, Cr, Bi, V, Pb, Zn, Ba, Cl, F.
** Taken from Simmons *et al.* (2003).

Pezzottaite is raspberry-red to pink, with moderate dichroism in hand specimen (Fig. 8): ω = pink-orange and ε = purplish pink to pinkish purple. The streak is colorless to white, crystals are transparent to translucent with a vitreous luster and no observable fluorescence in longwave and shortwave ultraviolet light. Crystals are brittle, with both conchoidal and irregular fractures, have an imperfect cleavage parallel to {001}, and no observable parting. Mohs hardness is 8, the observed density is 2.97 g/cm³ and the calculated density is 3.06 g/cm³. Pezzottaite is uniaxial negative with ε = 1.601–1.611 and ω = 1.612–1.620 depending on Cs content; these values are high for the beryl-type structure, but are in accord with the trends documented by Černý and Hawthorne (1976). Pezzottaite is strongly pleochroic in transmitted plane-polarized light, with orange-red $\|\varepsilon$ and purple-violet $\|\omega$.

CHEMICAL COMPOSITION

Crystals of pezzottaite were analyzed with an ARL-SEMQ electron microprobe operating in the wavelength-dispersion mode, with an accelerating voltage of 25 kV (15 kV for Na), a beam current of 15 nA, and a beam diameter of 3 µm. Both minerals and synthetic compounds were used as standards. The data were reduced and corrected by the ZAF method and are given in Table 1, together with Li_2O determined by ICP. The amount of H_2O was determined by LOI (Loss On Ignition) and by crystal-structure refinement (Hawthorne and Grice, 1990); the value obtained by LOI was 1.72 weight %, but this value is not representative of the amount of H_2O in the pezzottaite structure. First, the channel in the structure is nearly filled with Cs and other alkali cations, and there is no room for H_2O in the amount suggested by the LOI value. Second, careful examination of pezzottaite shows the common presence of large numbers of elongated fluid inclusions, suggesting that this high value is due to fluid inclusions rather than structural H_2O. The value of 0.28 weight % H_2O obtained by crystal-structure refinement is more reliable. Pezzottaite was also analyzed by LA-ICP-MS (Laser-Ablation Inductively Coupled Plasma Mass-Spectrometer), and the resultant chemical composition is given in Table 1. Chemical formulae were calculated on the basis of 18 O atoms (excluding H_2O) and are also given in Table 1. The end-member formula of pezzottaite is $Cs\,(Be_2\,Li)\,Al_2\,Si_6\,O_{18}$.

X-RAY POWDER DIFFRACTION

The powder-diffraction pattern was recorded with a Siemens D-5000 X-ray powder diffractometer equipped with an incident-beam monochrometer, a Peltier detector and CuK_$_1$ X-rays. Reflections were indexed by comparison of the observed pattern with the pattern calculated from the refined crystal structure of pezzottaite. Table 2 shows the X-ray powder-diffraction data and the refined unit-cell dimensions of pezzottaite, and a comparison of the beryl and pezzottaite diffraction patterns is shown in Figure 14.

INFRARED SPECTRUM

The infrared spectrum is shown in Figure 15. The pattern generally resembles that of beryl, but some bands are somewhat shifted in frequency from those of beryl. The broad envelope

Table 2. **X-ray powder-diffraction data for pezzottaite.**

$I_{est.}$	$d_{meas.}$ (Å)	$d_{calc.}$ (Å)	*h*	*k*	*l*
<1	7.992	7.987	1	1	0
4	4.642	4.643	0	0	6
10	4.611	4.617	0	3	0
2	4.013	4.010	$\bar{1}$	2	6
2	3.993	3.993	$\bar{2}$	4	0
100	3.271	3.272	0	3	6
41	3.027	3.028	$\bar{2}$	4	6
29	3.019	3.019	$\bar{1}$	5	0
52	2.871	2.872	$\bar{1}$	5	3
9	2.662	2.662	$\bar{3}$	6	0
6	2.321	2.321	0	0	12
6	2.309	2.309	$\bar{3}$	6	6
4	2.305	2.305	0	6	0
12	2.229	2.229	$\bar{1}$	2	12
14	2.215	2.215	$\bar{2}$	7	0
6	2.155	2.155	$\bar{2}$	7	3
9	2.065	2.065	0	6	6
2	1.999	1.999	$\bar{2}$	7	6
5	1.840	1.840	$\bar{1}$	5	12
3	1.834	1.834	$\bar{4}$	8	6
6	1.801	1.801	$\bar{2}$	7	9
12	1.749	1.749	$\bar{3}$	6	12
12	1.743	1.743	$\bar{3}$	9	0
10	1.713	1.713	$\bar{3}$	9	3
9	1.704	1.704	$\bar{1}$	8	6
14	1.636	1.635	0	6	12
6	1.632	1.632	$\bar{3}$	9	6
2	1.581	1.582	$\bar{1}$	5	15
3	1.577	1.577	$\bar{1}$	8	9
2	1.547	1.547	0	0	18
11	1.518	1.519	$\bar{3}$	9	9
1	1.514	1.514	$\bar{4}$	8	12
4	1.509	1.509	$\bar{2}$	10	0
2	1.490	1.490	$\bar{8}$	10	3
7	1.467	1.467	0	3	18
6	1.459	1.459	0	9	6
2	1.443	1.443	$\bar{2}$	4	18

a 15.973(4), *c* 27.849(11) Å, *V* 6153.1(3) Å^3, $R\bar{3}m$.

Table 3. **The minerals of the beryl group.**

	Beryl[1]	*Bazzite*[2]	*Stoppaniite*[3]	*Indialite*[4]	*Pezzottaite*[5]
a (Å)	9.21	9.501	9.397	9.8	15.946
c	9.194	9.178	9.202	9.345	27.803
V (Å^3)	675.4	717.5	703.7	777.3	6122
Space group	*P6/mcc*	*P6/mcc*	*P6/mcc*	*P6/mcc*	$R\bar{3}c$
Σ	1.577	1.607	1.619	1.532	1.611
ω	1.58	1.628	1.625	1.537	1.620
D (g/cm^3)	2.66	2.77	2.79	2.51	3.10
Z	2	2	2	2	18
2a	—	—	—	—	[Cs]
Be	Be_3	Be_3	Be_3	Al_2Si	[Be_2Li]
Al	Al_2	Sc_2	Fe_2^{3+}	Mg_2	[Al_2]

[1] Aurisicchio, *et al.* (1988); [2] Armbruster, *et al.* (1995); [3] Della Ventura, *et al.* (2000), Ferraris, *et al.* (1998); [4] Meagher & Gibbs (1977); [5] this work, values correspond to the most Cs-rich sample.

End-member formulae:

Beryl:	—	Be_3	Al_2	Si_6	O_{18}
Bazzite:	—	Be_3	Sc_2	Si_6	O_{18}
Stoppaniite:	—	Be_3	Fe_2^{3+}	Si_6	O_{18}
Indialite	—	(Al_2Si)	Mg_2	(Al_2Si_4)	O_{18}
Pezzottaite:	Cs	Be_2Li	Al_2	Si_6	O_{18}

centered at ~3600 cm^{-1} and the weak band at 1620 cm^{-1} indicate the presence of water (such as fluid inclusions), and the weak but sharp features between 3500 and 3600 cm^{-1} are from H_2O groups bound in the channels of the structure.

RELATED MINERALS

Pezzottaite, ideally $CsBe_2LiAl_2Si_6O_{18}$, is not isostructural with beryl, ideally $Be_3Al_2Si_6O_{18}$. However, the arrangement of the atoms in each structure is very similar, and the structures can be considered as very closely related. Table 3 lists the minerals that are isostructural with beryl, together with the minerals that have the same bond topology but different symmetry. Beryl ($Be_3Al_2Si_6O_{18}$), bazzite ($Be_3Sc_2Si_6O_{18}$), stoppaniite ($Be_3Fe_2^{3+}Si_6O_{18}$) and indialite ($Al_2SiMg_2Al_2Si_4O_{18}$) are isostructural with space group symmetry $P6_3/mcc$, whereas pezzottaite, $CsBe_2LiAl_2Si_6O_{18}$, is rhombohedral with space group symmetry $R\bar{3}c$. In beryl, Be occurs at one distinct position in the structure. In pezzottaite, one out of every three Be atoms is replaced by Li. The site occupied by Li is not symmetrically equivalent to the site occupied by Be, thus causing a difference in symmetry between the two structures. This change in symmetry is accompanied by a change in the size and orientation of the unit cell (Table 3). In beryl, Cs is incorporated into the channel at the 2a position (Hawthorne and Černý, 1977). Cesium occupies the analogous position in the pezzottaite structure, complete details of which will be presented in a future publication.

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[*Editor's note:* The crest on the title page is that of the Madagascar province of Fianarantsoa, wherein is located the type locality.]

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