



Figure 61. Pale-green carpholite crystals in red phyllites and psammites of the Karaova Formation. Outcrop width shown is ~15 cm.

to the walls of the cracks, but others were strongly sheared into an orientation parallel to the walls. In this outcrop, red phyllites and psammites contain two lineations: The NE-trending earlier linear fabric, marked by a mineral lineation, is overprinted by an E-W-trending linear crenulation fabric.

ACKNOWLEDGMENTS

The authors wish to gratefully acknowledge Ufuk Şüentürk (Power Division, Energy Holding, İzmir Turkey) for logistical support during the 2010 GSA Field Forum, and Tahir Öngür for his geothermal presentation as well as for his generous contribution toward the production cost of this field guide. Thanks also go to Vanessa Markwitz for editorial help; to Marion Bickford, Kent Condie, and April Leo for helpful and efficient editing; and to Stefan Schmid, Bob Miller, and Douwe van Hinsbergen for their reviews, which were a great help.

REFERENCES CITED

- Altherr, R., Kreuzer, H., Wendt, I., Lenz, H., Wagner, G.H., Keller, J., Harre, W., and Höhndorf, A., 1982, A late Oligocene/early Miocene high temperature belt in the Attic-Cycladic crystalline complex (SE Pelagonian, Greece): *Geological Journal*, v. E23, p. 97–164.
- Avigad, D., Ziv, A., and Garfunkel, Z., 2001, Ductile and brittle shortening, extension-parallel folds and maintenance of crustal thickness in the central Aegean: *Tectonics*, v. 20, p. 277–287, doi:10.1029/2000TC001190.
- Baker, B.R., Gessner, K., Holden, E.J., and Squelch, A.P., 2008a, Automatic detection of anisotropic features on rock surfaces: *Geosphere*, v. 4, p. 418–428, doi:10.1130/GES00145.1.
- Baker, C.B., Catlos, E.J., Sorensen, S., Çemen, I., and Hancer, M., 2008b, Evidence for polymetamorphic garnet growth in the Çine (southern Menderes) Massif: *Institute of Physics Conference Series: Earth and Environmental Science*, v. 2, doi:10.1088/1755-1307/2/1/012020.
- Barr, S.R., Temperley, S., and Tarney, J., 1999, Lateral growth of the continental crust through deep level subduction-accretion: A re-evaluation of central Greek Rhodope: *Lithos*, v. 46, p. 69–94.
- Bozkurt, E., 1995, Metamorphism of Palaeozoic schists in the southern Menderes Massif: Field, petrographic, textural and microstructural evidence: *Turkish Journal of Earth Sciences*, v. 5, p. 105–121.
- Bozkurt, E., 2007, Extensional v. contractional origin for the southern Menderes shear zone, SW Turkey: Tectonic and metamorphic implications: *Geological Magazine*, v. 144, p. 191–210, doi:10.1017/S0016756806002664.
- Bozkurt, E., and Oberhänsli, R., 2001, Menderes Massif (Western Turkey): Structural, metamorphic and magmatic evolution—A synthesis: *International Journal of Earth Sciences*, v. 89, p. 679–708, doi:10.1007/s005310000173.
- Bozkurt, E., and Park, G.R., 1994, Southern Menderes massif: An incipient metamorphic core complex in western Anatolia, Turkey: *Journal of the Geological Society [London]*, v. 151, p. 213–216, doi:10.1144/gsjgs.151.2.0213.
- Bozkurt, E., Park, G.R., and Winchester, J.A., 1993, Evidence against the core/cover interpretation of the southern sector of the Menderes massif, west Turkey: *Terra Nova*, v. 5, p. 445–451, doi:10.1111/j.1365-3121.1993.tb00282.x.
- Bozkurt, E., Park, G., Loos, S., and Reischmann, T., 2001, Discussion on the evolution of the Southern Menderes Massif in SW Turkey as revealed by zircon dating: *Journal of the Geological Society [London]*, v. 158, p. 393–395, doi:10.1144/jgs.158.2.393.
- Brichau, S., 2004, Constraining the tectonic evolution of extensional fault systems in the Cyclades (Greece) using low-temperature thermochronology [Ph.D. thesis]: Mainz, Germany, Johannes Gutenberg University, 165 p.
- Brichau, S., Ring, U., Carter, A., Bolhar, R., Monie, P., Stockli, D., and Brunel, M., 2008, Timing, slip rate, displacement and cooling history of the Mykonos detachment footwall, Cyclades, Greece, and implications for the opening of the Aegean Sea basin: *Journal of the Geological Society [London]*, v. 165, p. 263–277, doi:10.1144/0016-76492006-145.
- Brichau, S., Thomson, S., and Ring, U., 2010, Thermochronometric constraints on the tectonic evolution of the Serifos detachment, Aegean Sea, Greece: *International Journal of Earth Sciences*, v. 99, p. 379–393, doi:10.1007/s00531-008-0386-0.
- Brinkmann, R., 1967, The geology of western Anatolia: *Contributions to the Geology of Anatolia*, v. 7, p. 171–189.
- Brix, M.R., Stöckhert, B., Seidel, E., Theye, T., Thomson, S.N., and Küster, M., 2002, Thermobarometric data from a fossil partial annealing zone in high-pressure-low temperature rocks of eastern and central Crete, Greece: *Tectonophysics*, v. 349, p. 309–326, doi:10.1016/S0040-1951(02)00059-8.
- Brunn, J.H., Dumont, J.F., Graciansky, P., Gutnic, M., Juteau, T., Marcoux, J., Monod, O., and Poisson, A., 1971, Outline of the geology of the western Taurides, in Campbell, A.S., ed., *Geology and History of Turkey: Tripoli (Lybia)*, p. 225–255.
- Çağlayan, M.A., Öztürk, Z., Sav, H., and Akat, U., 1980, Menderes Masifi güneyine ait bulgular ve yaptısıral yorum: *Jeoloji Mühendisliği*, v. 10, p. 9–19.
- Candan, O., Dora, O.Ö., Oberhänsli, R., Çetinkaplan, M., Partzsch, J.H., Warkus, F.C., and Dürr, S., 1997, Blueschist relics in the Mesozoic cover series of the Menderes Massif and correlations with Samos Island, Cyclades: *Schweizerische Mineralogische und Petrographische Mitteilungen*, v. 77, p. 95–99.
- Candan, O., Dora, O.Ö., Oberhänsli, R., Çetinkaplan, M., Partzsch, J.H., Warkus, F.C., and Dürr, S., 2001, Pan-African high-pressure metamorphism in the Precambrian basement of the Menderes Massif, western Anatolia, Turkey: *International Journal of Earth Sciences*, v. 89, p. 793–811, doi:10.1007/s005310000097.
- Catlos, E.J., and Çemen, I., 2005, Monazite ages and the evolution of the Menderes Massif: *International Journal of Earth Sciences*, v. 94, p. 204–217, doi:10.1007/s00531-005-0470-7.
- Çemen, I., Catlos, E.J., Gögüs, O., and Öyerdem, C., 2006, Postcollisional extensional tectonics and exhumation of the Menderes massif in the Western Anatolia extended terrane, Turkey, in Dilek, Y., and Pavlides, S., eds., *Postcollisional Tectonics and Magmatism in the Mediterranean Region and Asia: Geological Society of America Special Paper 409*, p. 353–379.
- Chen, G., 1995, Evolution of the high- and medium-pressure metamorphic rocks on the island of Samos, Greece: *Annales géologiques des pays Helléniques*, v. 36, p. 799–915.
- Cohen, H.A., Dart, C.J., Akyüz, H.S., and Barka, A., 1995, Syn-rift sedimentation and structural development of the Gediz and Büyük Menderes graben, western Turkey: *Journal of the Geological Society [London]*, v. 152, p. 629–638, doi:10.1144/gsjgs.152.4.0629.

- Collins, A.C., Gessner, K., Ring, U., and Gungor, T., 2002, SHRIMP geochronology of granitoid rocks in the southern Anatolide Belt, western Turkey: Geological Society of America Abstracts with Programs, v. 34, no. 6, p. 250.
- Collins, A.S., and Robertson, A.H.F., 1997, Lycian mélange, southwest Turkey: An emplaced Cretaceous accretionary complex: *Geology*, v. 25, p. 255–258, doi:10.1130/0091-7613(1997)025<0255:LMSTAE>2.3.CO;2.
- Collins, A.S., and Robertson, A.H.F., 1998, Process of Late Cretaceous to Late Miocene episodic thrust-sheet translation in the Lycian Taurides: *Journal of the Geological Society [London]*, v. 155, p. 759–772, doi:10.1144/gsjgs.155.5.0759.
- Dannat, C., 1997, *Geochemie, Geochronologie und Nd- Sr-Isotopie der granitoiden Kerngneise des Menderes Massivs, SW-Türkei* [Ph.D. thesis]: Mainz, Germany, Johannes Gutenberg University, 120 p.
- Dannat, C., and Reischmann, T., 1999, Single zircon ages of migmatites from the Menderes Massif, SW Turkey: *European Union of Geosciences Journal of Conference Abstracts*, v. 4, p. 805.
- Dewey, J.F., and Şengör, A.M.C., 1979, Aegean and surrounding regions: Complex and multiplate continuum tectonics in a convergent zone: *Geological Society of America Bulletin*, v. 102, p. 812–829.
- Dora, O.Ö., Candan, O., Dürr, S.H., and Oberhänsli, R., 1995, New evidence of the tectonic evolution of the Menderes Massif, *Proceedings of International Earth Sciences Colloquium on the Aegean Region: Güllük (Turkey)*, v. 1, p. 53–72.
- Dürr, S.H., 1975, *Über Alter und geotektonische Stellung des Menderes-Kristallins/SW-Anatolien und seine Äquivalente in der mittleren Ägäis* [Habil thesis]: Marburg an der Lahn, Germany, Philipps-Universität, 107 p.
- Dürr, S.H., Altherr, R., Keller, J., Okrusch, M., and Seidel, E., 1978, The Median Aegean Crystalline belt: Stratigraphy, structure, metamorphism, magmatism, in Cloos, H., Roeder, D., and Schmidt, K., eds., *Alps, Apennines, Hellenides: Stuttgart, Schweitzerbart*, p. 455–477.
- Emre, T., and Sözbilir, H., 1997, Field evidence for metamorphic core complex, detachment faulting and accommodation faults in the Gediz and Büyük Menderes Grabens, Western Anatolia: *International Earth Science Colloquium on the Aegean and Surrounding Regions, Proceedings*, 1995, v. 1, p. 73–94.
- Emre, T., and Sözbilir, H., 2007, Tectonic evolution of the Kiraz Basin, Küçük Menderes Graben: Evidence for compression/uplift-related basin formation overprinted by extensional tectonics in West Anatolia: *Turkish Journal of Earth Sciences*, v. 16, p. 441–470.
- Engel, M., and Reischmann, T., 1998, Single zircon geochronology of orthogneisses from Paros, Greece: *Bulletin of the Geological Society of Greece*, v. 32, p. 91–99.
- Erdogan, B., and Güngör, T., 1992, Stratigraphy and tectonic evolution of the Northern Margin of the Menderes Massif: *Turkish Association of Petroleum Geologists Bulletin*, v. 4, p. 9–34.
- Erdogan, B., and Güngör, T., 2004, The problem of the core-cover boundary of the Menderes Massif and an emplacement mechanism for regionally extensive gneissic granites, western Anatolia (Turkey): *Turkish Journal of Earth Sciences*, v. 13, p. 15–36.
- Eyidogan, H., and Jackson, J., 1985, A seismological study of normal faulting in the Demirci, Alasehir and Gediz earthquakes of 1969–70 in western Turkey: Implications for the nature and geometry of deformation in the continental crust: *Geophysical Journal of the Royal Astronomical Society*, v. 81, p. 569–607.
- Faulds, J.E., Bouchot, V., Moeck, I., and Oguz, K., 2009, Structural controls on geothermal systems in Western Turkey: A preliminary report: *Geothermal Resources Council Transactions*, v. 33, p. 375–381.
- Fytikas, M., Innocenti, F., Manetti, P., Mazuoli, R., Peccerillo, A., and Villari, L., 1984, Tertiary to Quaternary evolution of volcanism in the Aegean region, in Dixon, J.E., and Robertson, A.H.F., eds., *The Geological Evolution of the Eastern Mediterranean: Geological Society [London] Special Publication 17*, p. 687–700.
- Gautier, P., Brun, J.P., Moriceau, R., Sokoutis, D., Martinod, J., and Jolivet, L., 1999, Timing, kinematics and cause of Aegean extension; a scenario based on a comparison with simple analogue experiments: *Tectonophysics*, v. 315, p. 31–72, doi:10.1016/S0040-1951(99)00281-4.
- Gemici, U., 2004, Impact of acid mine drainage from the abandoned Halikoy mercury mine (Western Turkey) on surface and groundwaters: *Bulletin of Environmental Contamination and Toxicology*, v. 72, p. 482–489, doi:10.1007/s00128-004-0271-x.
- Gemici, U., and Tarcan, G., 2007, Assessment of the pollutants in farming soils and waters around untreated abandoned Turkonu Mercury Mine (Turkey): *Bulletin of Environmental Contamination and Toxicology*, v. 79, p. 20–24, doi:10.1007/s00128-007-9087-9.
- Gessner, K., Ring, U., Lackmann, W., Passchier, C.W., and Gungor, T., 1998, Structure and crustal thickening of the Menderes Massif, southwest Turkey, and consequences for large-scale correlations between Greece and Turkey: *Deltio tes Ellenikes Geologikes Etaireias [Bulletin of the Geological Society of Greece]*, v. 32, p. 145–152.
- Gessner, K., Piazzolo, S., Gungor, T., Ring, U., Kroener, A., and Passchier, C.W., 2001a, Tectonic significance of deformation patterns in granitoid rocks of the Menderes nappes, Anatolide Belt, Southwest Turkey: *International Journal of Earth Sciences*, v. 89, p. 766–780, doi:10.1007/s005310000106.
- Gessner, K., Ring, U., Johnson, C., Hetzel, R., Passchier, C.W., and Gungor, T., 2001b, An active bivergent rolling-hinge detachment system; central Menderes metamorphic core complex in western Turkey: *Geology*, v. 29, p. 611–614, doi:10.1130/0091-7613(2001)029<0611:AABRHD>2.0.CO;2.
- Gessner, K., Ring, U., Passchier, C.W., and Gungor, T., 2001c, How to resist subduction: Evidence for large-scale out-of-sequence thrusting during Eocene collision in western Turkey: *Journal of the Geological Society [London]*, v. 158, p. 769–784, doi:10.1144/jgs.158.5.769.
- Gessner, K., Ring, U., Passchier, C.W., Hetzel, R., and Okay, A.I., 2002, Stratigraphic and metamorphic inversions in the central Menderes Massif; a new structural model; discussion and reply: *International Journal of Earth Sciences*, v. 91, p. 168–172, doi:10.1007/s005310100223.
- Gessner, K., Collins, A.S., Ring, U., and Gungor, T., 2004, Structural and thermal history of poly-orogenic basement: U-Pb geochronology of granitoid rocks in the southern Menderes Massif, Western Turkey: *Journal of the Geological Society [London]*, v. 161, p. 93–101, doi:10.1144/0016-764902-166.
- Glodny, J., Bingen, B., Austrheim, H., Molina, J.F., and Rusin, A., 2002, Precise eclogitisation ages deduced from Rb/Sr mineral systematics: The Maksyutov complex, Southern Urals, Russia: *Geochimica et Cosmochimica Acta*, v. 66, p. 1221–1235, doi:10.1016/S0016-7037(01)00842-0.
- Glodny, J., Ring, U., and Kühn, A., 2008, High-pressure metamorphism, thrusting, strike-slip and extensional shearing in the Tauern Window, Eastern Alps: All starting at the same time?: *Tectonics*, v. 27, TC4004, doi:10.1029/2007TC002193.
- Godfriaux, I., 1968, *Etude géologique de la région de l'Olympe (Grèce: Annales géologiques des pays Helléniques)*, v. 19, 271 p.
- Güngör, T., 1998, *Stratigraphy and tectonic evolution of the Menderes Massif in the Söke-Selçuk Region* [Ph.D. thesis]: Izmir, Turkey, Dokuz Eylül University, 147 p., 1 plate.
- Hancock, P.L., and Barka, A.A., 1987, Kinematic indicators on active normal faults in western Turkey: *Journal of Structural Geology*, v. 9, p. 573–584, doi:10.1016/0191-8141(87)90142-8.
- Hejl, E., Riedl, H., and Weingartner, H., 2002, Post-plutonic unroofing and morphogenesis of the Attic-Cycladic complex (Aegea, Greece): *Tectonophysics*, v. 349, p. 37–56.
- Hetzel, R., and Reischmann, T., 1996, Intrusion age of Pan-African augen gneisses in the southern Menderes massif and the age of cooling after Alpine ductile extensional deformation: *Geological Magazine*, v. 133, p. 565–572, doi:10.1017/S0016756800007846.
- Hetzel, R., Passchier, C.W., Ring, U., and Dora, O.Ö., 1995a, Bivergent extension in orogenic belts: The Menderes massif, southwestern Turkey: *Geology*, v. 23, p. 455–458, doi:10.1130/0091-7613(1995)023<0455:BEIOBT>2.3.CO;2.
- Hetzel, R., Ring, U., Akal, C., and Troesch, M., 1995b, Miocene NNE-directed extensional unroofing in the Menderes massif, southwestern Turkey: *Journal of the Geological Society [London]*, v. 152, p. 639–654, doi:10.1144/gsjgs.152.4.0639.
- Hetzel, R., Romer, R.L., Candan, O., and Passchier, C.W., 1998, Geology of the Bozdag area, central Menderes massif, SW-Turkey: Pan African basement and Alpine deformation: *Geologische Rundschau*, v. 87, p. 394–406, doi:10.1007/s005310050218.
- Huvaz, O., Karahanoglu, N., and Ediger, V., 2007, The thermal gradient history of the Thrace Basin, NW Turkey: Correlation with basin evolution processes: *Journal of Petroleum Geology*, v. 30, p. 3–24, doi:10.1111/j.1747-5457.2007.00003.x.
- Isik, V., and Tekeli, O., 2001, Structure of lower plate rocks in metamorphic core complex: Northern Menderes Massif, Western Turkey: *International Journal of Earth Sciences*, v. 89, p. 757–765.

- Jacobshagen, V., 1986, *Geologie von Griechenland*: Berlin, Borntraeger, 363 p.
- Jolivet, L., and Brun, J.P., 2010, Cenozoic geodynamic evolution of the Aegean: *International Journal of Earth Sciences*, v. 99, p. 109–138, doi:10.1007/s00531-008-0366-4.
- Jolivet, L., Goffé, B., Monié, P., Truffert-Luxey, C., Patriat, M., and Bonneau, M., 1996, Miocene detachment in Crete and exhumation P-T-t paths of high-pressure metamorphic rocks: *Tectonics*, v. 15, p. 1129–1153, doi:10.1029/96TC01417.
- Katzir, Y., Avigad, D., Matthews, A., Garfunkel, Z., and Evans, B.W., 2000, Origin, HP/LT metamorphism and cooling of ophiolitic mélanges in southern Evia (NW Cyclades), Greece: *Journal of Metamorphic Geology*, v. 18, p. 699–718, doi:10.1046/j.1525-1314.2000.00281.x.
- Keay, S., 1998, The geological evolution of the Cyclades, Greece: Constraints from SHRIMP U-Pb geochronology [Ph.D. thesis]: Canberra, Australian National University, 335 p.
- Kopf, A., Mascle, J., and Klaeschen, D., 2003, The Mediterranean Ridge: A mass balance across the fastest growing accretionary complex on Earth: *Journal of Geophysical Research*, v. 108, 2372, doi:10.1029/2001JB000473.
- Koralay, O.E., Satir, M., and Dora, O.Ö., 2001, Geochemical and geochronological evidence for Early Triassic calc-alkaline magmatism in the Menderes Massif, western Turkey: *International Journal of Earth Sciences*, v. 89, p. 822–835, doi:10.1007/s005310000134.
- Kumerics, C., Ring, U., Bricchau, S., Glodny, J., and Monie, P., 2005, The extensional Messaria shear zone and associated brittle detachment faults, Aegean Sea, Greece: *Journal of the Geological Society [London]*, v. 162, p. 701–721, doi:10.1144/0016-764904-041.
- Lips, A.L.W., 1998, Temporal constraints on the kinematics of the destabilization of an orogen; syn- to post-orogenic collapse of the Northern Aegean region: *Geologica Ultraiectina*, v. 166, 223 p.
- Lips, A.L.W., Wijbrans, J.R., and White, S.H., 1999, New insights from $^{40}\text{Ar}/^{39}\text{Ar}$ laserprobe dating of white mica fabrics from the Pelion Massif, Pelagonian Zone, Internal Hellenides, Greece: Implications for the timing of metamorphic episodes and tectonic events in the Aegean region, in Durand, B., Jolivet, L., Horvath, F., and Seranne, M., eds., *The Mediterranean Basins: Tertiary Extension within the Alpine Orogen*: Geological Society [London] Special Publication 156, p. 457–474, doi:10.1144/GSL.SP.1999.156.01.21.
- Lips, A.L.W., Cassard, D., Sözbilir, H., Yilmaz, H., and Wijbrans, J.R., 2001, Multistage exhumation of the Menderes Massif, western Anatolia (Turkey): *International Journal of Earth Sciences*, v. 89, p. 781–792, doi:10.1007/s005310000101.
- Loos, S., and Reischmann, T., 1999, The evolution of the southern Menderes Massif in SW Turkey as revealed by zircon dating: *Journal of the Geological Society [London]*, v. 156, p. 1021–1030, doi:10.1144/gsjgs.156.5.1021.
- Makris, J., and Stobbe, C., 1984, Physical properties and state of the crust and upper mantle of the Eastern Mediterranean Sea deduced from geophysical data: *Marine Geology*, v. 55, p. 347–363, doi:10.1016/0025-3227(84)90076-8.
- Mposkos, E., 1978, Diasporit- und Smirgelvorkommen der Insel Samos (Griechenland): *International Congress for the Study of Bauxite*, v. 2, p. 614–631.
- Oberhänsli, R., Candan, O., Dora, O.Ö., and Dürr, S.H., 1997, Eclogites within the Menderes Massif/western Turkey: *Lithos*, v. 41, p. 135–150, doi:10.1016/S0024-4937(97)82009-9.
- Oberhänsli, R., Monié, P., Candan, O., Warkus, F.C., Partzsch, J., and Dora, O.Ö., 1998a, The age of blueschist metamorphism in the Mesozoic cover series of the Menderes Massif: *Schweizerische Mineralogische und Petrographische*, v. 78, p. 309–316.
- Oberhänsli, R., Partzsch, J., Çetinkaplan, M., and Candan, O., 1998b, HP record in the Lycian Nappes (western Turkey): *Ankara, International Turkish Geology Symposium*, 3rd, p. 274.
- Oberhänsli, R., Partzsch, J.H., Candan, O., and Çetinkaplan, M., 2001, First occurrence of Fe-Mg-carpholite documenting a high pressure metamorphism in metasediments of the Lycian Nappes, SW Turkey: *International Journal of Earth Sciences*, v. 89, p. 867–873, doi:10.1007/s005310000103.
- Okay, A.I., 2001, Stratigraphic and metamorphic inversions in the central Menderes Massif: A new structural model: *International Journal of Earth Sciences*, v. 89, p. 709–727, doi:10.1007/s005310000098.
- Okay, A.I., 2011, A regional olistostrome-mélange belt formed along a major strike-slip tear fault: Bornova Flysch Zone, western Turkey: *Geophysical Research Abstracts*, v. 13, p. EGU2011-689.
- Okay, A.I., and Tüysüz, O., 1999, Tethyan sutures of northern Turkey, in Durand, B., Jolivet, L., Horvath, E., and Seranne, M., eds., *The Mediterranean Basins: Tertiary Extension within the Alpine Orogen*: Geological Society [London] Special Publication 156, p. 475–515.
- Okay, A., Harris, N.B.W., and Kelley, S.P., 1998, Exhumation of blueschists along a Tethyan suture in northwest Turkey: *Tectonophysics*, v. 285, p. 275–299, doi:10.1016/S0040-1951(97)00275-8.
- Okrusch, M., and Bröcker, M., 1990, Eclogite facies rocks in the Cycladic blueschist belt, Greece: A review: *European Journal of Mineralogy*, v. 2, p. 451–478.
- Özer, S., and Sözbilir, H., 2003, Presence and tectonic significance of Cretaceous rudist species in the so-called Permo-Carboniferous Göktepe Formation, central Menderes metamorphic massif, western Turkey: *International Journal of Earth Sciences*, v. 92, p. 397–404, doi:10.1007/s00531-003-0333-z.
- Özer, S., Sözbilir, H., Özkar, I., Tokar, V., and Sari, B., 2001, Stratigraphy of Upper Cretaceous–Palaeogene sequences in the southern and eastern Menderes Massif (western Turkey): *International Journal of Earth Sciences*, v. 89, p. 852–866, doi:10.1007/s005310000142.
- Özkaymak, C., and Sözbilir, H., 2008, Stratigraphic and structural evidence for fault reactivation: The active Manisa fault zone, western Anatolia: *Turkish Journal of Earth Sciences*, v. 17, p. 615–635.
- Pe-Piper, G., and Piper, D.J.W., 1984, Tectonic setting of the Mesozoic Pindos basin of the Peloponnese, Greece, in Dixon, J.E., and Robertson, A.H.F., eds., *The Geological Evolution of the Eastern Mediterranean*: Geological Society [London] Special Publication 17, p. 563–567.
- Pe-Piper, G., and Piper, D.J.W., 2002, The Igneous Rocks of Greece: The Anatomy of an Orogen: Berlin, Gebrüder Borntraeger, 573 p.
- Pourteau, A., Candan, O., and Oberhänsli, R., 2010, High-pressure metasediments in central Turkey: Constraints on the Neotethyan closure history: *Tectonics*, v. 29, TC5004, doi:10.1029/2009TC002650.
- Putlitz, B., Cosca, M.A., and Schumacher, J.C., 2005, Prograde mica $^{40}\text{Ar}/^{39}\text{Ar}$ growth ages recorded in high pressure rocks (Syros, Cyclades, Greece): *Chemical Geology*, v. 214, p. 79–98, doi:10.1016/j.chemgeo.2004.08.056.
- Régnier, J.L., Ring, U., Passchier, C.W., Gessner, K., and Güngör, T., 2003, Contrasting metamorphic evolution of metasedimentary rocks from the Çine and Selimiye nappes in the Anatolide belt, western Turkey: *Journal of Metamorphic Geology*, v. 21, p. 699–721, doi:10.1046/j.1525-1314.2003.00473.x.
- Régnier, J.L., Metzger, J.E., and Passchier, C.W., 2006, Metamorphism of Precambrian–Palaeozoic schists of the Menderes core series and contact relationships with Proterozoic orthogneisses of the western Çine Massif, Anatolide belt, western Turkey: *Geological Magazine*, v. 144, p. 67–104, doi:10.1017/S0016756806002640.
- Reiners, P.W., and Brandon, M.T., 2006, Using thermochronology to understand orogenic erosion: *Annual Review of Earth and Planetary Sciences*, v. 34, p. 419–466, doi:10.1146/annurev.earth.34.031405.125202.
- Reischmann, T., 1997, Single zircon Pb/Pb dating of tectonic units from the Metamorphic Complex of Naxos, Greece: *Terra Nova*, v. 9, p. 496.
- Reischmann, T., and Loos, S., 2001, Discussion on the evolution of the Southern Menderes Massif in SW Turkey as revealed by zircon dating: *Journal of the Geological Society [London]*, v. 158, p. 393–395, doi:10.1144/jgs.158.2.393.
- Reischmann, T., Kröner, A., Todt, W., Dürr, S., and Şengör, A.M.C., 1991, Episodes of crustal growth in the Menderes Massif, W Turkey, inferred from zircon dating: *TERRA Abstracts*, v. 3, p. 34.
- Rimmelé, G., Oberhänsli, R., Jolivet, L., and Goffé, B., 2001, First structural data related to the low-grade high-pressure metamorphism in the metasediments of the Lycian nappes, SW Turkey: *European Union of Geosciences XI Journal of Conference Abstracts*, p. 319.
- Ring, U., and Layer, P.W., 2003, High-pressure metamorphism in the Aegean, eastern Mediterranean: Underplating and exhumation from the Late Cretaceous until the Miocene to Recent above the retreating Hellenic subduction zone: *Tectonics*, v. 22, 1022, doi:10.1029/2001TC001350.
- Ring, U., and Reischmann, T., 2002, The weak and superfast Cretan detachment, Greece: Exhumation at subduction rates in extrusion wedges: *Journal of the Geological Society [London]*, v. 159, p. 225–228, doi:10.1144/0016-764901-150.
- Ring, U., Gessner, K., Güngör, T., and Passchier, C.W., 1999a, The Menderes Massif of western Turkey and the Cycladic Massif in the Aegean—Do they really correlate?: *Journal of the Geological Society [London]*, v. 156, p. 3–6, doi:10.1144/gsjgs.156.1.0003.

- Ring, U., Laws, S., and Bernet, M., 1999b, Structural analysis of a complex nappe sequence and late-orogenic basins from the Aegean Island of Samos, Greece: *Journal of Structural Geology*, v. 21, p. 1575–1601, doi:10.1016/S0191-8141(99)00108-X.
- Ring, U., Layer, P.W., and Reischmann, T., 2001a, Miocene high-pressure metamorphism in the Cyclades and Crete, Aegean Sea, Greece: Evidence for large-magnitude displacement on the Cretan detachment: *Geology*, v. 29, p. 395–398, doi:10.1130/0091-7613(2001)029<0395:MHPMIT>2.0.CO;2.
- Ring, U., Willner, A.P., and Lackmann, W., 2001b, Stacking of nappes with unrelated pressure-temperature paths: An example from the Menderes nappes of western Turkey: *American Journal of Science*, v. 301, p. 912–944, doi:10.2475/ajs.301.10.912.
- Ring, U., Johnson, C., Hetzel, R., and Gessner, K., 2003a, Tectonic denudation of a Late Cretaceous–Tertiary collisional belt: Regionally symmetric cooling patterns and their relation to extensional faults in the Anatolide belt of western Turkey: *Geological Magazine*, v. 140, p. 421–441, doi:10.1017/S0016756803007878.
- Ring, U., Thomson, S.N., and Bröcker, M., 2003b, Fast extension but little exhumation: The Vari detachment in the Cyclades, Greece: *Geological Magazine*, v. 140, p. 245–252, doi:10.1017/S0016756803007799.
- Ring, U., Buchwaldt, R., and Gessner, K., 2004, Pb/Pb dating of garnet from the Anatolide Belt in western Turkey: regional implications and speculations on the role Anatolia played during the amalgamation of Gondwana: *Zeitschrift der Deutschen Geologischen Gesellschaft*, v. 154, p. 537–555.
- Ring, U., Will, T., Glodny, J., Kumerics, C., Gessner, K., Thomson, S., Gungor, T., Monie, P., Okrusch, M., and Druppel, K., 2007a, Early exhumation of high-pressure rocks in extrusion wedges: Cycladic blueschist unit in the eastern Aegean, Greece, and Turkey: *Tectonics*, v. 26, TC2001, doi:10.1029/2005TC001872.
- Ring, U., Glodny, J., Will, T., and Thomson, S.N., 2007b, An Oligocene extrusion wedge of blueschist-facies nappes on Evia Island, Aegean Sea, Greece: Implications for the early exhumation of high-pressure rocks: *Journal of the Geological Society [London]*, v. 164, p. 637–652, doi:10.1144/0016-76492006-041.
- Ring, U., Thomson, S.N., and Rosenbaum, G., 2009, Timing of the Amorgos detachment system and implications for detachment faulting in the southern Aegean Sea, Greece, in Ring, U., and Wernicke, B., eds., *Extending a Continent: Architecture, Rheology, and Heat Budget*: Geological Society [London] Special Publication, v. 321, p. 244–255.
- Ring, U., Glodny, J., Will, T., and Thomson, S.N., 2010, The Hellenic subduction system: High-pressure metamorphism, exhumation, normal faulting and large-scale extension: *Annual Review of Earth and Planetary Sciences*, v. 38, p. 45–76, doi:10.1146/annurev.earth.050708.170910.
- Ring, U., Glodny, J., Will, T., and Thomson, S.N., 2011, Normal faulting on Sifnos and the South Cycladic Detachment System, Aegean Sea, Greece: *Journal of the Geological Society [London]*, v. 168, p. 751–768, doi:10.1144/0016-76492010-064.
- Robertson, A.H.F., Clift, P.D., Degnan, P.J., and Jones, G., 1991, Palaeogeographic and palaeotectonic evolution of the Eastern Mediterranean Neotethys: *Palaeogeography, Palaeoclimatology, Palaeoecology*, v. 87, p. 289–343, doi:10.1016/0031-0182(91)90140-M.
- Romano, S.S., Dörr, W., and Zulauf, G., 2004, Cambrian granitoids in pre-Alpine basement of Crete (Greece): Evidence from U-Pb dating of zircon: *International Journal of Earth Sciences*, v. 93, p. 844–859, doi:10.1007/s00531-004-0422-7.
- Schaffer, F., 1900, Das Maeanderthalbeben vom 20. September 1899: *Mitteilungen der kaiserlichen und königlichen geographischen Gesellschaft Wien*, v. 43, p. 221–230.
- Schuiling, R.D., 1962, On petrology, age and structure of the Menderes Migmatite complex (SW-Turkey): *Bulletin of the Institute for Mineral Research and Exploration*, v. 58, p. 71–83.
- Seidel, E., Kreuzer, H., and Harre, W., 1982, A late Oligocene/early Miocene high pressure belt in the External Hellenides: *Geologisches Jahrbuch*, v. 23, p. 165–206.
- Şengör, A.M.C., and Yilmaz, Y., 1981, Tethyan evolution of Turkey: A plate tectonic approach: *Tectonophysics*, v. 75, p. 181–241, doi:10.1016/0040-1951(81)90275-4.
- Şengör, A.M.C., Satir, M., and Akkök, R., 1984, Timing of the tectonic events in the Menderes massif, western Turkey: Implications for tectonic evolution and evidence for Pan-African basement in Turkey: *Tectonics*, v. 3, p. 693–707, doi:10.1029/TC003i007p00693.
- Seyitoglu, G., Anderson, D., Nowell, G., and Scott, B., 1997, The evolution from Miocene potassic to Quaternary sodic magmatism in western Turkey: Implications for enrichment processes in the lithospheric mantle: *Journal of Volcanology and Geothermal Research*, v. 76, p. 127–147, doi:10.1016/S0377-0273(96)00069-8.
- Shaked, Y., Avigad, D., and Garfunkel, Z., 2000, Alpine high-pressure metamorphism at the Almyropotamos window (southern Evia, Greece): *Geological Magazine*, v. 137, p. 367–380, doi:10.1017/S001675680000426X.
- Sherlock, S., Kelley, S., Inger, S., Harris, N., and Okay, A., 1999, ⁴⁰Ar–³⁹Ar and Rb–Sr geochronology of high-pressure metamorphism and exhumation history of the Tavsanli Zone, NW Turkey: *Contributions to Mineralogy and Petrology*, v. 137, p. 46–58, doi:10.1007/PL00013777.
- Sotiropoulos, S., Kamberis, E., Triantaphyllou, M.V., and Doutsos, T., 2003, Thrust sequences in the central part of the External Hellenides: *Geological Magazine*, v. 140, p. 661–668, doi:10.1017/S0016756803008367.
- Stampfli, G.M., Borel, G.D., Cavazza, W., Mosar, J., and Ziegler, P.A., 2001, Palaeotectonic and palaeogeographic evolution of the western Tethys and Peri-Tethyan domain (IGCP Project 369): *Episodes*, v. 24, p. 222–227.
- Theodoropoulos, D., 1979, Geological map of Greece, 1:50000, Samos Island: Athens, Greece, Institute of Geology and Mineral Exploration.
- Thomson, S.N., and Ring, U., 2006, Thermochronologic evaluation of post-collision extension in the Anatolide Orogen, western Turkey: *Tectonics*, v. 25, TC3005, doi:10.1029/2005TC001833.
- Thomson, S.N., Stöckert, B., Rauche, H., and Brix, M.R., 1998, Apatite fission-track thermochronology of the uppermost tectonic unit of Crete, Greece: Implications for the post-Eocene tectonic evolution of the Hellenic Subduction System, in Van den haute, P., and De Corte, F., eds., *Advances in Fission-Track Geochronology*: Dordrecht, Netherlands, Kluwer Academic Publishers, p. 187–205.
- Thomson, S.N., Stöckert, B., and Brix, M.R., 1999, Miocene high-pressure metamorphic rocks of Crete, Greece: Rapid exhumation by buoyant escape, in Ring, U., Brandon, M.T., Lister, G.S., and Willett, S.D., eds., *Exhumation Processes: Normal Faulting, Ductile Flow and Erosion*: Geological Society [London] Special Publication 154, p. 87–107, doi:10.1144/GSL.SP.1999.154.01.04.
- Thomson, S.N., Ring, U., Bricchau, S., Glodny, J., and Will, T., 2009, Timing and nature of formation of the Ios metamorphic core complex, southern Cyclades, Greece, in Ring, U., and Wernicke, B., eds., *Extending a Continent: Architecture, Rheology and Heat Budget*: Geological Society [London] Special Publication 321, p. 269–274.
- Tomaschek, F., Kennedy, A., Villa, I., Lagos, M., and Ballhaus, C., 2003, Zircons from Syros, Cyclades, Greece—Crystallization and mobilization during high pressure metamorphism: *Journal of Petrology*, v. 44, p. 1977–2002, doi:10.1093/petrology/egg067.
- Uzel, B., and Sözbilir, H., 2008, A first record of a strike-slip basin in western Anatolia and its tectonic implication: The Cumaovasi basin: *Turkish Journal of Earth Sciences*, v. 17, p. 559–591.
- Vamvaka, A., Kiliyas, A.D., Mountrakis, D., and Papaikononou, J., 2006, Geometry and structural evolution of the Mesohellenic Trough (Greece): A new approach, in Robertson, A.H.F., and Mountrakis, D., eds., *Tectonic Development of the Eastern Mediterranean Region*: Geological Society [London] Special Publication 260, p. 521–538.
- van Hinsbergen, D.J.J., 2010, A key extensional metamorphic complex reviewed and restored: The Menderes Massif of western Turkey: *Earth-Science Reviews*, v. 102, p. 60–76, doi:10.1016/j.earscirev.2010.05.005.
- van Hinsbergen, D.J.J., Hafkenscheid, E., Spakman, W., Meulenkamp, J.E., and Wortel, R., 2005, Nappe stacking resulting from continental lithosphere below subduction of oceanic and continental lithosphere below Greece: *Geology*, v. 33, p. 325–328, doi:10.1130/G20878.1.
- van Hinsbergen, D.J.J., Kaymakci, N., Spakman, W., and Torsvik, T.H., 2010, Reconciling the geological history of western Turkey with plate circuits and mantle tomography: *Earth and Planetary Science Letters*, v. 297, p. 674–686, doi:10.1016/j.epsl.2010.07.024.
- von Quadt, A., Moritz, R., Peytcheva, I., and Heinrich, C.A., 2005, Geochronology and geodynamics of Late Cretaceous magmatism and Cu–Au mineralization in the Panagyurishte region of the Apuseni–Banat–Timok–Srednogorie belt, Bulgaria: *Ore Geology Reviews*, v. 27, p. 95–126.
- Weidmann, M., Solounias, N., Drake, R., and Curtis, G.H., 1984, Neogene stratigraphy of the eastern basin, Samos island, Greece: *Geobios*, v. 17, p. 477–490, doi:10.1016/S0016-6995(84)80020-0.
- Whitney, D.L., and Bozkurt, E., 2002, Metamorphic history of the southern Menderes Massif: Western Turkey: *Geological Society of America Bulletin*,

- v. 114, p. 829–838, doi:10.1130/0016-7606(2002)114<0829:MHOTSM>2.0.CO;2.
- Wijbrans, J.R., Schliestedt, M., and York, D., 1990, Single grain argon laser probe dating of phengites from the blueschist to greenschist transition on Sifnos (Cyclades, Greece): *Contributions to Mineralogy and Petrology*, v. 104, p. 582–593, doi:10.1007/BF00306666.
- Wijns, C., Weinberg, R., Gessner, K., and Moresi, L., 2005, Mode of crustal extension determined by rheological layering: *Earth and Planetary Science Letters*, v. 236, p. 120–134, doi:10.1016/j.epsl.2005.05.030.
- Will, T., Okrusch, M., Schmädicke, E., and Chen, G., 1998, Phase relations in the greenschist-blueschist-amphibolite-eclogite facies in the system Na₂O-CaO-FeO-MgO-Al₂O₃-SiO₂-H₂O (NCFMASH), with application to metamorphic rocks from Samos, Greece: *Contributions to Mineralogy and Petrology*, v. 132, p. 85–102, doi:10.1007/s004100050406.

MANUSCRIPT ACCEPTED BY THE SOCIETY 26 MAY 2011

- v. 114, p. 829–838, doi:10.1130/0016-7606(2002)114<0829:MHOTSM>2.0.CO;2.
- Wijbrans, J.R., Schliestedt, M., and York, D., 1990, Single grain argon laser probe dating of phengites from the blueschist to greenschist transition on Sifnos (Cyclades, Greece): *Contributions to Mineralogy and Petrology*, v. 104, p. 582–593, doi:10.1007/BF00306666.
- Wijns, C., Weinberg, R., Gessner, K., and Moresi, L., 2005, Mode of crustal extension determined by rheological layering: *Earth and Planetary Science Letters*, v. 236, p. 120–134, doi:10.1016/j.epsl.2005.05.030.
- Will, T., Okrusch, M., Schmädicke, E., and Chen, G., 1998, Phase relations in the greenschist-blueschist-amphibolite-eclogite facies in the system Na₂O-CaO-FeO-MgO-Al₂O₃-SiO₂-H₂O (NCFMASH), with application to metamorphic rocks from Samos, Greece: *Contributions to Mineralogy and Petrology*, v. 132, p. 85–102, doi:10.1007/s004100050406.

MANUSCRIPT ACCEPTED BY THE SOCIETY 26 MAY 2011