

PUBLICATIONS LIST

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A. PEER-REVIEWED PUBLICATIONS

- (93) **Aulbach S**, Höfer HE, Gerdes A, Tinguely C, le Roex A (accepted) Mélange signatures and low oxygen fugacity in eclogite xenoliths from the crust-mantle transition below a Mesoproterozoic collision belt. *Journal of Geophysical Research Solid Earth*
- (92) **Aulbach S**, Stalder R, Massuyeau M, Stern RA, Ionov DA, Korsakov AV (2023) Water in omphacite and garnet from pristine xenolithic eclogite: T-X- fO_2 controls, retentivity and implications for electrical conductivity and deep H₂O recycling. *Geochemistry Geophysics Geosystems*, 24, e2023GC011170: doi.org/10.1029/2023GC011170
- (91) Stagno V, Bindi L, Bonechi B, Greaux S, **Aulbach S**, Irifune T, Lupi S, Marras G, McCammon CA, Nazzari M, Piccirilli F, Poe BT, Romano C, Scarlato P (2023) Cubic Fe-bearing majorite synthesized at 18-25 GPa and 1000 °C: implications for element transport, subducted slab rheology and diamond formation. *Scientific Reports* 13: doi.org/10.1038/s41598-023-43037-6
- (90) Lin A-B, **Aulbach S**, Zheng J-P, Uenver-Thiele L, Woodland AB, Zhang H-F (2023) Petrogenesis, Sampling Depth, Thermal and Redox Evolution of Spinel Peridotite Xenoliths From Jiaohe, NE China: Insights From Trace Elements in All Rock-Forming Silicate Minerals. *Journal of Geophysical Research Solid Earth* 128: e2023JB026777, doi.org/10.1029/2023JB026777
- (89) Puziewicz J, **Aulbach S**, Kaczmarek M-A, Ntaflos T, Gerdes A, Mazurek H, Kukuła A, Matusiak-Małek M, Tedonkenfack SST, Ziobro-Mikrut M (2023) The origin and evolution of DMM-like lithospheric mantle beneath continents: Mantle xenoliths from the Oku Volcanic Group in the Cameroon Volcanic Line, West Africa. *Journal of Petrology* 64: doi.org/10.1093/petrology/egad049
- (88) **Aulbach S**, Smart KA (2023) Petrogenesis and geodynamic significance of xenolithic eclogites. *Annual Review of Earth and Planetary Sciences* 51 doi.org/10.1146/annurev-earth-031621-112904 – *BY INVITATION*
- (87) **Aulbach S**, Woodland AB, Stagno V, Korsakov AV, Mikhailenko D, Golovin A (2022) Fe³⁺ distribution and Fe³⁺/ΣFe-oxygen fugacity variations in eclogite xenoliths, with comments on clinopyroxene-garnet oxy-thermobarometry. *Journal of Petrology* 63: doi.org/10.1093/petrology/egac076 – *EDITOR'S CHOICE*
- (86) Simonov VA, Vasil'ev YuR, Kotlyarov AV, Nikolenko EI, Alifirova TA, Sharygin VV, **Aulbach S** (2022) Physicochemical Parameters of Ultrabasic Magmatic Systems of the Northeastern Siberian Platform (Data on Melt Inclusions in Chromian Spinel). *Russian Geology and Geophysics* 63: doi.org/10.2113/RGG20204313
- (85) Lin A-B, **Aulbach S**, Zheng, J-P, Cai R, Liu J, Xiong Q, Pan S-K (2022) Lithospheric mantle provinces and crust-mantle decoupling beneath northeastern China: Insights from peridotite xenoliths. *GSA Bulletin* 135: doi.org/10.1130/B36338.1

- (84) **Aulbach S**, Stachel T (2022) Evidence for oxygen-conserving diamond formation in redox-buffered subducted oceanic crust sampled as eclogite. *Nature Communications* 13: 1924, doi.org/10.1038/s41467-022-29567-z
- (83) Mikhailenko DS, **Aulbach S**, Korsakov AV, Xu Y, Kaminsky FV (2022) Titanite in coesite-kyanite-bearing eclogite from kimberlite pipe Udachnaya. *Doklady Earth Sciences* 503: 168-174, doi.org/10.1134/S1028334X22040122
- (82) O'Neill C, **Aulbach S** (2022) Destabilisation of Deep Oxidized Mantle Drove the Great Oxidation Event. *Science Advances* 8: doi/10.1126/sciadv.abg1626
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- (80) Smit KV, Timmerman S, **Aulbach S**, Shirey SB, Richardson SH, Phillips D, Pearson DG (2022) Geochronology of diamonds. *Reviews in Mineralogy and Geochemistry – Natural Diamonds: Their Mineralogy, Geochemistry, and Genesis*. Editors: Nestola F, Pearson DG, Shirey SB, Stachel T, Smit KV, Moses T. *Mineralogical Society of America* 87: doi.org/10.2138/rmg.2022.88.11
- (79) Stagno V, **Aulbach S** (2022) Redox processes before, during and after Earth's accretion affecting the deep carbon cycle. In: Moretti R, Neuville DR (eds): *Magma Redox Geochemistry*. *Geophysical Monograph Series*, pp. 19-32, doi.org/10.1002/9781119473206.ch2
- (78) Gudelius D, **Aulbach S**, Seitz H-M, Braga R (2022) Crustal fluids cause strong Lu-Hf fractionation and Hf-Nd-Li isotopic provinciality in the mantle of continental subduction zones. *Geology* 50: 163-187, doi.org/10.1130/G49317.1
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- (76) Mikhailenko DS, **Aulbach S**, Korsakov AV, Golovin AV, Malygina EV, Gerdes A, Stepanov AS, Xu Y-G (2021) Origin of graphite-diamond-bearing eclogites from Udachnaya kimberlite pipe. *Journal of Petrology* 62: egab033, doi.org/10.1093/petrology/egab033 – *EDITOR'S CHOICE*
- (75) Tedonkenfack SST, Puziewicz J, **Aulbach S**, Ntaflos T, Kaczmarek M-A, Matusiak-Małek M, Kukuła A, Ziobro M (2021) Lithospheric mantle refertilization by DMM-derived melts beneath the Cameroon Volcanic Line – a case study of the Befang xenolith suite (Oku Volcanic Group, Cameroon). *Contributions to Mineralogy and Petrology* 176: 37
- (74) González-Jiménez JM, **Aulbach S**, Smit KV, Timmerman S, Giuliani A, Mondal S (2021) Origin and evolution of continental mantle lithosphere and its resource endowment: Preface. *Lithos* 384-385:105965
- (73) Matusiak- Małek M, Puziewicz J, Ntaflos T, Woodland A, Uenver-Thiele L, Büchner J, Grégoire M, **Aulbach S** (2021) Variable origin of clinopyroxene megacrysts carried by Cenozoic volcanic rocks from the eastern limb of Central European Volcanic Province (SE Germany and SW Poland). *Lithos* 382-383: 105963
- (72) **Aulbach S**, Giuliani A, Fiorentini ML, Baumgartner RJ, Savard D, Kamenetsky VS, Caruso S, Danyushevsky LV, Powell W, Griffin WL (2021) Siderophile and

- chalcophile elements in spinels, sulphides and native Ni in strongly metasomatised xenoliths from the Bultfontein kimberlite (South Africa). *Lithos* 380-381: 105880.
- (71) Massuyeau M, Gardes E, Rogerie G, **Aulbach S**, Tappe S, Le Trong E, Sifré D, Gaillard F (2021) MAGLAB: a computing platform connecting melting and geophysical signals in the Earth's upper mantle. *Physics of The Earth and Planetary Interiors* 314:106638
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- (69) **Aulbach S** (2020) Temperature-dependent rutile solubility in garnet and clinopyroxene from mantle eclogite: Implications for continental crust formation and V-based oxybarometry. *Journal of Petrology* 61, DOI: 10.1093/petrology/egaa065
- (68) Lin A, Zheng J-P, **Aulbach S**, Xiong Q, Pan S-K, Gerdes A (2020) Causes and consequences of wehrlitization beneath a trans-lithospheric fault: Evidence from Mesozoic basalt-borne wehrlite xenoliths from the Tan-Lu fault belt, North China Craton. *Journal of Geophysical Research - Solid Earth* 124, e2019JB019084
- (67) **Aulbach S**, Viljoen KS, Gerdes A (2020) Diamondiferous and barren eclogites from the western Kaapvaal craton record subduction metasomatism and mantle metasomatism, respectively. *Lithos* 368-369: 105588
- (66) **Aulbach S**, Massuyeau M, Garber JM, Gerdes A, Heaman LM, Viljoen KS (2020) Ultramafic carbonated melt- and auto-metasomatism in mantle eclogites: Compositional effects and geophysical consequences. *Geochemistry Geophysics Geosystems* 21(5): e2019GC008774
- (65) Teng F-Z, Lee C-T, **Aulbach S**, Liu X-M (2020) The continents: Origin, evolution, and interactions with other reservoirs. *Geochimica et Cosmochimica Acta* 278: 1-5
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- (63) Mikhailenko DS, Golovin AV, Korsakov AV, **Aulbach S**, Gerdes A, Ragozin A (2020) Metasomatic Evolution of Coesite-Bearing Diamondiferous Eclogite from the Udachnaya Kimberlite. *Minerals* 10: 383
- (62) Puziewicz J, Matusiak-Malek M, Ntaflos T, Grégoire M, Kaczmarek MA, **Aulbach S**, Ziobro M, Kukuła A (2020) Three major types of subcontinental lithospheric mantle beneath the Variscan orogen in Europe. *Lithos* 362-363: 105467
- (61) Stagno V, Cerantola V, **Aulbach S**, Lobanov S, McCammon CA, Merlini M (2020) Carbon bearing phases throughout Earth - evolution through space and time. In: Orcutt BN, Danielle I, Dasgupta R (eds): *Deep Carbon: Past to Present*. Cambridge University Press. DOI: 10.1017/9781108677950
- (60) Shirey SB, Smit KV, Pearson DG, Walter MJ, **Aulbach S** et al. (2020) Diamonds and the Mantle Geodynamics of Carbon: Deep Mantle Evolution from the Diamond Record. In: Orcutt BN, Danielle I, Dasgupta R (eds): *Deep Carbon: Past to Present*. Cambridge University Press. DOI: 10.1017/9781108677950
- (59) Howell D, Stachel T, Stern RA, Pearson G, Nestola F, Hardman MF, Harris JW, Jaques L, Shirey SB, Cartigny P, Smit KV, **Aulbach S**, Brenker F, Jacob DE, Thomassot E, Walter MJ, Navon O (2020) Deep carbon through time: The

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- (58) Brüske A, Martin AN, Rammensee P, Eroglu S, Lazarov M, Albut G, Schuth S, **Aulbach S**, Schoenberg R, Beukes N, Hofmann A, Nägler T, Weyer S (2020) The onset of oxidative continental weathering traced by uranium isotopes. *Precambrian Research* 338: 105583
- (57) **Aulbach S**, Woodland AB, Stern RA, Vasilyev P, Heaman LM, Viljoen KS (2019) Evidence for a dominantly reducing Archaean ambient mantle from two redox proxies, and low oxygen fugacity of deeply subducted oceanic crust. *Scientific Reports* 9: 20190. DOI: 10.1038/s41598-019-55743-1
- (56) Alemayehu M, Guo F, **Aulbach S** (2019) Transformation of continental lithospheric mantle beneath the East African Rift: Constraints from platinum-group elements and Re-Os isotopes in mantle xenoliths from Ethiopia. *Contributions to Mineralogy and Petrology* 174: 40
- (55) **Aulbach S**, Höfer HE, Gerdes A (2019) High-Mg mantle eclogites from Koidu (West African craton): Neoproterozoic ultramafic melt metasomatism of subducted Archaean plateau-like oceanic crust. *Journal of Petrology* 60: 723-754
- (54) Gudelius D, **Aulbach S**, Braga R, Höfer H, Woodland AB, Gerdes A (2019) Element transfer and redox conditions in continental subduction zones: New insights from peridotites of the Ulten Zone, N Italy. *Journal of Petrology* 60: 231-268
- (53) Lin A-B, Zheng J-P, Xiong Q, **Aulbach S**, Dai H-K, Pan S-K, Lu J-G, Zhang H (2019) A refined model for lithosphere evolution beneath the decratonized northeastern North China Craton. *Contributions to Mineralogy and Petrology* 174: 15
- (52) **Aulbach S**, Sun J, Tappe S, Gerdes A (2019) Effects of multi-stage rifting and metasomatism on PGE-¹⁸⁷Os/¹⁸⁸Os systematics of the cratonic mantle beneath SW Greenland. *Contributions to Mineralogy and Petrology* 174: 16
- (51) **Aulbach S**, Arndt N (2019) Origin of high-Mg biminerally eclogite xenoliths in kimberlite – Reply to comment from Claude Herzberg. *Earth and Planetary Science Letters* 510: 234-237. doi.org/10.1016/j.epsl.2018.10.025
- (50) **Aulbach S**, Arndt NT (2019) Eclogites as Palaeodynamic Archives: Evidence for Warm (not hot) and Depleted (but heterogeneous and evolving) Archaean Ambient Mantle. *Earth and Planetary Science Letters* 505: 162-172
- (49) **Aulbach S**, Heaman LM, Jacob DE, Viljoen KS (2019) Ages and sources of mantle eclogites: ID-TIMS and in situ MC-ICPMS Pb-Sr isotope systematics of clinopyroxene. *Chemical Geology* 503: 15-28
- (48) **Aulbach S** (2019) Cratonic Lithosphere Discontinuities: Dynamics of Small-Volume Melting, Meta-Cratonisation and a Possible Role for Brines. *Invited contribution to "Lithospheric Discontinuities"*. Editors: Yuan H, Romanowicz B. American Geophysical Union, Washington DC, pp. 177-204.
- (47) Stachel T, Banas A, **Aulbach S**, Smit KV, Wescott P, Chinn I, Kong J (2018) The Victor Mine (Superior Craton, Canada): Neoproterozoic Iherzolitic diamonds from a thermally-modified cratonic root. *Mineralogy and Petrology* 112: S325-S336
- (46) **Aulbach S**, Heaman LM, Stachel T (2018) The Diamondiferous Mantle Root Beneath the central Slave Craton. *Invited contribution to "Geoscience and*

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- (45) **Aulbach S**, Creaser RA, Stachel T, Heaman LM, Chinn IL, Kong J (2018) Sulphide inclusions in diamond from Victor (Superior Craton): Intra-mantle cycling of volatiles (C,N,S) and Os during plate reorganisation. *Earth and Planetary Science Letters* 490: 77-87
- (44) **Aulbach S**, Sun J, Tappe S, Höfer HE, Gerdes A (2017) Volatile-rich Metasomatism in the Cratonic Mantle Beneath SW Greenland: Link to Kimberlites and Mid-Lithospheric Discontinuities. *Journal of Petrology* 58: 2311-2338
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- (42) **Aulbach S**, Woodland AB, Vasilyev P, Galvez ME, Viljoen KS (2017) Effects of low-pressure igneous processes and subduction on $Fe^{3+}/\Sigma Fe$ and redox state of mantle eclogites from Lace (Kapaavaal craton). *Earth and Planetary Science Letters* 474: 283-295
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- (39) Alemayehu M, Zhang H-F, **Aulbach S** (2017) Persistence of fertile and hydrous lithospheric mantle beneath the northwestern Ethiopian plateau: Evidence from modal, trace element and Sr-Nd-Hf isotopic compositions of amphibole-bearing mantle xenoliths. *Lithos* 284-285: 401-415
- (38) **Aulbach S**, Massuyeau M, Gaillard F (2017) Origins of cratonic mantle discontinuities: A view from petrology, geochemistry and thermodynamic models. Invited review article. *Lithos* 268-271: 364-382, doi.org/10.1016/j.lithos.2016.11.004
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- (34) Alemayehu M, Zhang H-F, **Aulbach S** (2016) Evaluation of mantle processes in an extensional regime: Insight from in-situ O and Sr isotope systematics of mantle xenoliths from Ethiopia. *The Journal of Geology* 124: 603-616

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- (32) Jansen M, **Aulbach S**, Hauptmann A, Höfer HE, Klein S, Krüger M, Zettler RL (2016) Platinum Group Placer Minerals in Ancient Gold Artifacts - Geochemistry and Osmium Isotopy of Inclusions in Early Bronze Age Gold from Ur/Mesopotamia. *Journal of Archaeological Science* 68: 12-23
- (31) **Aulbach S**, Gerdes A, Viljoen KS (2016) Formation of diamondiferous kyanite-eclogite in a subduction mélange. *Geochimica Cosmochimica Acta* 179: 156-176
- (30) **Aulbach S**, Mungall JE, Pearson DG (2016) Distribution and processing of highly siderophile elements in cratonic mantle lithosphere. *Invited contribution to "Reviews in Geochemistry and Mineralogy - Highly siderophile and strongly chalcophile elements in high temperature geochemistry and cosmochemistry"* Editors: Day J, Harvey J. *Mineralogical Society of America* 81: 239-304, doi.org/10.2138/rmg.2016.81.5
- (29) **Aulbach S**, Viljoen F (2015) Eclogite xenoliths from the Lace kimberlite, Kaapvaal craton: From convecting mantle source to palaeo-ocean floor and back. *Earth and Planetary Science Letters* 431: 274-286
- (28) Liu L, Yang X, Santosh M, **Aulbach S**, Geng J, Sun W (2015) Neoproterozoic intraplate crustal accretion on the northern margin of the Yangtze Block: Evidence from geochemistry, zircon SHRIMP U-Pb dating and Hf isotopes from the Fuchashan Complex. *Precambrian Research* 268: 97-114
- (27) Liu L, Yang X, Santosh M, **Aulbach S** (2015) Neoproterozoic to Paleoproterozoic continental growth in the southeastern margin of the North China Craton: Geochemical, zircon U-Pb and Hf isotope evidence from the Huoqiu complex. *Gondwana Research* 28: 1002-1018
- (26) Bianchini G, Bonadiman C, **Aulbach S**, Schutt D (2015) Preface - Constraints on Composition, Structure and Evolution of the Lithosphere. *Tectonophysics* 650: 1-2
- (25) Liu L, Xiao Y, **Aulbach S**, Li DY, Hou Z (2014) Vanadium and Niobium partitioning into rutile as a function of oxygen fugacity: Evidence from natural samples. *Contributions to Mineralogy and Petrology* 167: 1026
- (24) **Aulbach S**, Luchs T, Brey GP (2014) Distribution and Behaviour During Metasomatism of PGE-Re and Os Isotopes in Off-Craton Mantle Xenoliths From Namibia. *Lithos* 184-187: 478-490
- (23) **Aulbach S**, Griffin WL, Pearson NJ, O'Reilly SY (2013) Nature and Timing of Metasomatism in the Stratified Mantle Lithosphere Beneath the Central Slave Craton (Canada). *Chemical Geology* 352: 153-169
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- (21) **Aulbach S** (2012) Craton Nucleation and Formation of Thick Lithospheric Roots. *Lithos* 15: 16-30
- (20) **Aulbach S**, Stachel T, Heaman LM, Carlson JA (2011) Microxenoliths from the Slave craton: Archives of diamond formation along fluid conduits. *Lithos* 126: 419-434

- (19) **Aulbach S**, O'Reilly SY, Pearson NJ (2011) Constraints from eclogite and MARID xenoliths on origins of mantle Zr/Hf–Nb/Ta variability. *Contributions to Mineralogy and Petrology* 162: 1047-1062
- (18) **Aulbach S**, Stachel T, Heaman LM, Creaser RA, Shirey SB (2011) Formation of Cratonic Subcontinental Lithospheric Mantle and Complementary Komatiite from Hybrid Plume Sources. *Contributions to Mineralogy and Petrology* 161: 947-960
- (17) **Aulbach S**, Rudnick RL, McDonough WF (2011) Lithospheric mantle sources within the East African rift, Tanzania. *Invited contribution* to “Volcanism and evolution of the African lithosphere”. Editors: Beccaluva L, Bianchini G, Wilson M. Geological Society of America Special Paper 478:105-126
- (16) **Aulbach S**, Krauss C, Creaser RA, Stachel T, Heaman LM, Matveev S, Chacko T (2010) Granulite Sulphides as Tracers of Lower Crustal Origin and Evolution: An Example from the Slave craton, Canada. *Geochim Cosmochim Acta* 74: 5368-5381
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- (14) **Aulbach S**, Creaser RA, Pearson NJ, Simonetti SS, Heaman LM, Griffin WL, Stachel T (2009) Sulfide and whole rock Re-Os systematics of eclogite and pyroxenite xenoliths from the Slave Craton, Canada. *Earth and Planetary Science Letters* 283: 48-58
- (13) **Aulbach S**, Shirey SB, Stachel T, Creighton S, Muehlenbachs K, Harris JW (2009) Multiple diamond formation episodes at the Kaapvaal craton margin: Re-Os of Jagersfontein sulfide inclusions. *Contributions to Mineralogy and Petrology* 127: 525-540
- (12) Bell DR, Hervig RL, Buseck PR, **Aulbach S** (2009) Lithium isotope analysis of olivine by SIMS: calibration of a matrix effect and application to magmatic phenocrysts. *Chemical Geology* 258: 5-16
- (11) **Aulbach S**, Rudnick RL (2009) Origins and timing of non-equilibrium lithium isotopic fractionation in xenolithic peridotite minerals: Examples from Tanzania. *Chemical Geology* 258: 17-27
- (10) **Aulbach S**, Griffin WL, Pearson NJ, O'Reilly SY (2008) Subcontinental lithospheric mantle origin of high Nb/Ta in eclogite xenoliths. *Nature Geoscience* 1: 468-472 – *Our Title Foto for Nature Geoscience 1 issue*
- (9) **Aulbach S**, Rudnick RL, McDonough WF (2008) Li-Sr-Nd isotope signatures of the plume and cratonic lithospheric mantle beneath the margin of the rifted Tanzanian Craton (Labait). *Contributions to Mineralogy and Petrology* 155: 79-92
- (8) **Aulbach S**, Pearson NJ, O'Reilly SY, Doyle BJ (2007) Origins of xenolithic eclogites and pyroxenites from the central Slave Craton, Canada. *Journal of Petrology* 48: 1843-1873
- (7) **Aulbach S**, Griffin WL, Pearson NJ, O'Reilly SY, Doyle BJ (2007) Lithosphere formation in the central Slave Craton (Canada): Plume subcretion or lithosphere accretion? *Contributions to Mineralogy and Petrology* 154: 409-427
- (6) Stachel T, **Aulbach S**, Brey GP, Harris JW, Leost I, Tappert R, Viljoen KS (2004) The trace element composition of silicate inclusions in diamonds: a review. *Lithos* 77: 1-19

- (5) **Aulbach S**, Griffin WL, O'Reilly SY, McCandless TE (2004) Genesis and evolution of the lithospheric mantle beneath the Buffalo Head Terrane, Alberta. *Lithos* 77: 413-451
- (4) **Aulbach S**, Griffin WL, Pearson NJ, O'Reilly SY, Doyle BJ, Kivi K (2004) Mantle formation and evolution beneath the Slave Craton from HSE abundances and Re-Os isotope systematics of sulfide inclusions in mantle xenocrysts. *Chemical Geology* 208: 61-88
- (3) Griffin WL, O'Reilly SY, Abe N, **Aulbach S**, Davies RM, Pearson NJ, Doyle BJ, Kivi K (2003) The origin and evolution of Archean lithospheric mantle, *Precambrian Research* 127: 19-41
- (2) Stachel T, Harris JW, **Aulbach S**, Deines P (2002) Kankan diamonds (Guinea) III: $\delta^{13}\text{C}$ and nitrogen characteristics of deep diamonds. *Contributions to Mineralogy and Petrology* 142: 465-475
- (1) **Aulbach S**, Stachel T, Viljoen KS, Brey GP, Harris JW (2002) Eclogitic and websteritic diamond sources beneath the Limpopo Belt - is slab-melting the link? *Contributions to Mineralogy and Petrology* 143: 56-70

B. SUBMITTED AND INVITED

- (4) Mikhailenko DS, Stepanov AS, **Aulbach S**, Korsakov AV, Zhang L, Xu Y-G (resubmitted after revision) Allanite in mantle eclogite xenoliths. *Journal of Petrology*
- (3) Puchtel I, Walker R, **Aulbach S**, Bennett V (2024) Os isotopes – understanding Earth's infancy (working title). In: Re-Os – clock with clout. *Elements – BY INVITATION*
- (2) **Aulbach S**, Brounce M (under moderate revision/publication Sep 2024) The redox state of Earth's mantle (working title). *Treatise on Geochemistry 3rd edition – BY INVITATION*
- (1) Reisberg L, **Aulbach S** (accepted/publication Sep 2024) The lithospheric mantle. *Treatise on Geochemistry 3rd edition – BY INVITATION*

C. INVITED CONFERENCE PRESENTATIONS

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