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Reinterpreting the Tectonic Model of the Southern Part of the Taconic Orogeny through a Provenance Study of Late Ordovician Sandstones

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REINTERPRETING THE TECTONIC MODEL OF THE SOUTHERN PART OF THE TACONIC OROGENY THROUGH A PROVENANCE STUDY OF LATE ORDOVICIAN SANDSTONES

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Para ti mamá y papá. Gracias por enseñarme que con esfuerzo, perserverancia y fe todo es posible.

Y en especial para ti, tío Antonio. Gracias por enseñarme a vivir viendo siempre el lado bueno a todo lo que ocurre en esta vida. Le agradezco a Dios el haberme dado un tío como tú, alegre y amoroso.

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ABSTRACT

A provenance study of quartz arenites that stratigraphically are closely associated with major Ordovician K-bentonites has been conducted in order to further our understanding of the tectonic setting of eastern Laurentia during the Late Ordovician. Using laser ablation ICP-MS, detrital zircons separated from Ordovician sandstone samples in the southeastern Appalachian Mountains (Virginia to Alabama) were dated using U-Pb geochronology. Analytical results show three dominate age ranges for the zircons from these sandstones: ~440-490 Ma, ~900-1300 Ma, and ~1300-1500 Ma. In addition, some zircon ages grouped into older ranges of ~1600-1800 Ma, ~1800-1900 Ma, and ~2600-2800 Ma. Zircon ages from ~900-2800 Ma have all been previously identified in passive margin Cambrian sandstones, supporting a multi-cycle source for the Ordovician quartz arenites. The younger age signal of ~440-490 Ma, which becomes stronger to the south, is attributed to the K-bentonites because the sandstones were being deposited right after or, in some locations, during the eruptions. The tectonic setting for the Laurentian margin at this time was likely analogous to the current subduction of the Philippine Sea Plate underneath the east Asian continental margin (Ryukyu Arc area). The Laurentian continental crust was warped during the orogeny, and the Taconic Highlands and associated foredeep were created, in which detritus from older sedimentary rock and volcanics (tephras) were deposited.

The eruptions that created these tephras have been estimated to have been larger than the historic Tambora and Toba eruptions, leading to inconsistencies with an island arc volcanic system due to no clear silica-rich source for these massive eruptions. However, the aforementioned Ryukyu Arc system helps explain a process by which volcanics can be erupted through continental (silica-rich) margin sediments via the dehydration and melting of a subducted slab. The proximity between a possible immature island arc system and quartz-rich

sandstones is also troublesome. The U-Pb ages determined from the detrital zircons, as well as the size and nature of the K-bentonites found, led to the conclusion that these quartz-rich sandstones were produced in a humid and tropical climate with a high degree of chemical weathering and transport through an extended flood/coastal plain.

INTRODUCTION

For years, geologists have been working to develop an accurate model of what happened in the southern part of the Taconic Orogeny. Drake et al. (1989) stated: “It certainly appears that a major problem in Appalachian geology is to quantify a realistic causative mechanism for Taconian deformation in the central and southern Appalachians.” This study aims to help understand that mechanism.

The Taconic Orogeny is commonly known as the first of three mountain-building events that created today’s Appalachian Mountains. The tectonic model for the northern part of the orogeny has been generally agreed upon by various authors throughout extensive studies (e.g. Chapple, 1973; Robinson and Hall, 1980; Rowley and Kidd, 1981; Stanley and Ratcliffe, 1985; Karabinos et al., 1998; Waldron and van Staal, 2001; Zagorevski et al., 2006; van Staal et al., 2007). However, for the southern part, some controversy exists.

The generally accepted tectonic model for the northern part of the orogeny (from Newfoundland to southern New York) consists of a volcanic island arc created by a subduction zone off the eastern coast of the Laurentian continent, and subsequent collision of that arc with the Laurentian craton, an event that created tectonic highlands during the Ordovician (e.g. Coler et al., 2000; Eriksson et al., 2004). This same geologic process is extrapolated into central and southern parts of the orogeny (Virginia Appalachians) by Mussman and Read (1986), including the formation of an accretionary prism. However, in the southern part of the orogeny, past studies discussing the petrology of two K-bentonites deposited within the molasse sequence in the adjacent foredeep (Huff et al., 1992; Haynes, 1994; Huff, 2008; Huff et al., 2010; Haynes and Goggin, 2011) provide compelling evidence to challenge the standard model within this region.

The K-bentonites' eruptions are estimated to have been larger than the historic Tambora and Toba eruptions (Huff et al., 1992; Haynes, 1994). These types of explosive eruptions typically occur when sourced by rhyolitic magmas (felsic, higher silica content), as opposed to basaltic magmas (Huff et al., 2010). Silica rich (>72 wt% SiO_2) and volatile rich (commonly H_2O) magmas are particularly explosive due to the low-density bubbles produced by H_2O during decompression that can expand cataclysmically (Bachmann and Bergantz, 2008). The high silica content makes the liquid extremely viscous, thus trapping bubbles and causing the mixture to become exceedingly buoyant (Bachmann and Bergantz, 2008). A trace element study by Huff et al. (1992) showed the felsic characteristics of one of these K-bentonites and concluded that a significant component of the parent magma came from continental crust, while the study by Kolata et al. (1998) of these K-bentonites added that the source could be one or more magmatic centers located in continental crust.

By contrast, other studies that have focused on geologic relations in Alabama, Georgia, and the Carolinas have hypothesized the existence of a back-arc basin system to explain the tectonic setting for the southern part of the Taconic Orogeny (Tull et al., 2014; Barineau et al., 2015). In their model, the Blount foredeep is hypothesized to have formed in a retroarc basin next to the back-arc basin caused by a west dipping subduction zone. In that model, then, it is required that the northern and southern parts of the Taconic Orogeny be connected via a transform boundary, so as to account for the switch in subduction directions (Tull et al., 2014; Barineau et al., 2015).

Using a provenance study to understand how the sedimentary rocks surrounding the K-bentonites formed can shed light on the tectonic setting of this area during the Late Ordovician. Sedimentary rocks can include eroded and transported fragments of previous igneous,

metamorphic, and sedimentary rocks (Spencer and Kirkland, 2015), and provenance studies give us a way to reconstruct paleogeographical settings in order to better understand how certain geological formations came to be. By determining U-Pb radiometric ages (through U-Pb geochronology on detrital zircon grains from quartz arenites that are stratigraphically associated with these K-bentonites), one can identify potential source terranes for these sands. Samples of these Upper Ordovician sandstones were collected from Alabama to Virginia (Fig. 1) in order to obtain detrital zircons from them for radiometric dating, with the goal of furthering our understanding of the evolution of the basin at different paleogeographic locations.

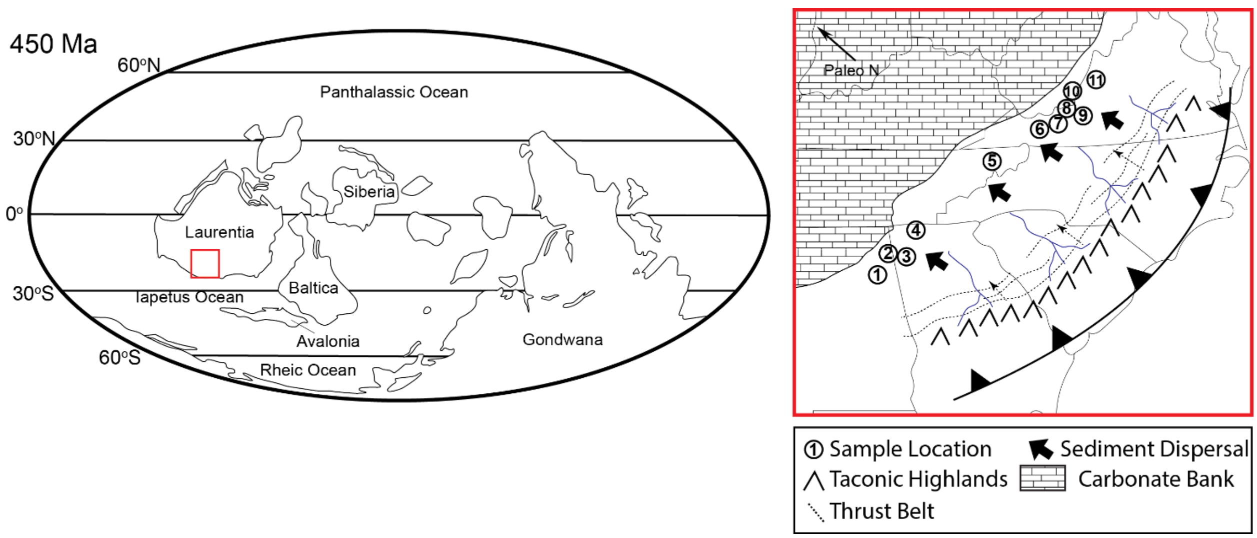

Figure 1. Paleogeography during the Late Ordovician [modified from Torsvik and Cocks (2013). Inset shows Taconic highlands, associated foreland basin, and sample locations [modified from Haynes (1994)]. Sample locations include: [1] Alexander Gap, AL (33.90011°N 85.91659°W); [2] Dirtseller Mountain, AL (34.26946°N 85.61204°W); [3] Horseleg Mountain, GA (34.22755°N 85.24566°W); [4] Reed Road, GA (34.82733°N 84.97808°W); [5] Dodson Mountain, TN (36.34248°N 82.95024°W); [6] Nebo, VA (36.92709°N 81.44176°W); [7] Crockett Cove, VA (36.99218°N 81.07780°W); [8] Gap Mountain, VA (37.25268°N 80.60900°W); [9] Ellett, VA (37.19001°N 80.35858°W); [10] Gap Mills, WV (37.56355°N 80.41196°W); [11] McGraw Gap, VA (37.85806°N 79.86625°W)

These ages can also aid in determining the different processes that were involved in order for these grains to come to their final resting place (Gehrels, 2014). Identifying the ages of certain detrital minerals within sediments has become a common practice in the earth sciences in order to answer different geologic questions (Fedo et al., 2003), and zircon, in particular, is used due to its chemical and mechanical durability (Hoskin and Schaltegger, 2003).

BACKGROUND

Bloutian Tectophase

The Ordovician Taconic Orogeny has been separated into two distinct tectophases: the Blountian tectophase and the Taconian tectophase (Rodgers, 1953, 1971), with Drake et al. (1989) even considering the Blountian phase as its own separate tectonic event. Centered in the southern Appalachians during the Middle Ordovician, the Blountian phase occurred first (Rodgers, 1953), and it was essentially completed before the Taconian phase started (Drake et al., 1989). It began with what some authors (e.g. Faill, 1997; McClellan et al., 2007) hypothesize was a collision between an island arc and/or microcontinents and the Laurentian craton margin (Ettensohn and Lierman, 2012). During this collision, a foreland basin formed from Alabama to northern Virginia (Ettensohn and Lierman, 2012), called the Sevier Basin by some authors (e.g. Drake et al., 1989; Ettensohn and Lierman, 2012), and the Blount Basin by others (e.g. Bayona and Thomas, 2003, 2006; Haynes and Goggin, 2011).

The tectonic instability that began as the eastern margin of Laurentia switched tectonic settings from a passive to a convergent margin is marked regionally by the widespread Knox unconformity (Mussman and Read, 1986; Drake et al., 1989). This unconformity marks the top of Ordovician carbonates referred to as Upper Knox Group in the Virginia-Tennessee area and Beekmantown Group in northern Virginia through New York. Overlying the unconformity are Middle Ordovician foreland basin carbonates and shales (Mussman et al., 1988). The unconformity is widespread not only regionally but on a global level as well, and thus is hypothesized to have been caused at least in part by a eustatic sea level fall (Sloss, 1963; Mussman and Read, 1986; Mussman et al., 1988). However, tectonics also affected its development, at least along the Laurentian margin, because the margin was being converted from

a passive margin to a convergent margin (Shanmugam and Walker, 1980; Mussman and Read, 1986). Some studies suggest that the Knox unconformity might have formed when the shelf passed over a peripheral bulge which had formed during easternward subduction of the Laurentian continental margin underneath a magmatic arc (Hatcher, 1972; Slaymaker and Watkins, 1978; Shanmugam and Walker, 1980; Jacobi, 1981; Quinlan and Beaumont, 1984).

As the collision began (~460 Ma), the passive Cambrian-Ordovician carbonate shelf edge began subsiding, the karstic Knox surface was flooded, and the first sediments to accumulate above the unconformity were deposited as part of transgressive carbonate sequences (e.g. Mosheim to Lenoir, and New Market to Lincolnshire formations) (Rodgers, 1971; Read, 1980; Ettensohn and Lierman, 2012). These shallow water marine carbonates were then followed by what in many sections is a stratigraphically rather abrupt change to dark, deep-water, graptolitic shales (e.g. Athens, Blockhouse, Paperville formations) representing basinal and turdiditic deposition, as widespread deepening occurred which then graded upward into flysch clastic sediments (e.g. Knobs, Sevier, Tellico formations) (Carter and Chowns, 1986; Chowns, 1986; Carter and Chowns, 1988; Ettensohn and Lierman, 2012). The flysch units then grade upward into red molasse units (e.g. Bays, Greensport, Moccasin formations) which contain marginal-marine, peritidal, carbonate and clastic-rich redbeds (Carter and Chowns, 1986, 1988; Ettensohn and Lierman, 2012) and several quartz arenites (Mack, 1985; Haynes and Goggin, 2011; Herrmann and Haynes, 2015), which collectively record the filling of the basin (Carter and Chowns, 1988). It is also within these molasse sequences that various Ordovician K-bentonites are found along eastern North America (Haynes, 1994; Kolata et al., 1996, 1998).

Molasse Sandstones and Stratigraphic Relationship to K-Bentonites

A standard collisional tectonic model has molasse sequences (coarse continental clastics) derived from the eroding mountain belt being deposited within the adjacent foreland basin during waning stages of orogenic activity (Van der Pluijm and Marshak, 2004). The molasse sediments deposited during the last stages of the Blountian tectophase include the redbeds of the Moccasin, Bays, and Greensport formations (Ettensohn and Lierman, 2012). The coarsest sediments in these redbeds are quartz-rich arenites and granule and pebble conglomerates (Haynes and Goggin, 2011; Herrmann and Haynes, 2015), including the Colvin Mountain Sandstone of Alabama and Georgia, the "Middle" Sandstone Member of the Bays Formation in Tennessee, and the Walker Mountain Sandstone Member of the Bays, Moccasin, and Eggleston formations in Virginia and West Virginia, samples from each of which were analyzed in this study.

It is important to understand the depositional timing of the quartz-rich sandstones throughout the basin. Analyzing their stratigraphic positions in relation to the Deicke (454.5 ± 0.5 Ma) and the Millbrig (453.1 ± 1.3 Ma) (Tucker, 1992; Tucker and McKerrow, 1995) K-bentonites (Fig. 2) can give a better idea of when these sandstones were deposited. The sandstones, in order from oldest to youngest, are the "Middle" Sandstone in Tennessee, the Walker Mountain Sandstone in Virginia and West Virginia, and Colvin Mountain Sandstone in Georgia and Alabama (Haynes and Goggin, 2011). This change in depositional timing along strike shows that the first tectonic activity caused by the Blountian tectophase was in the area of present-day Tennessee, followed by the area of Virginia and West Virginia, and later the area of Georgia and Alabama (Haynes and Goggin, 2011).

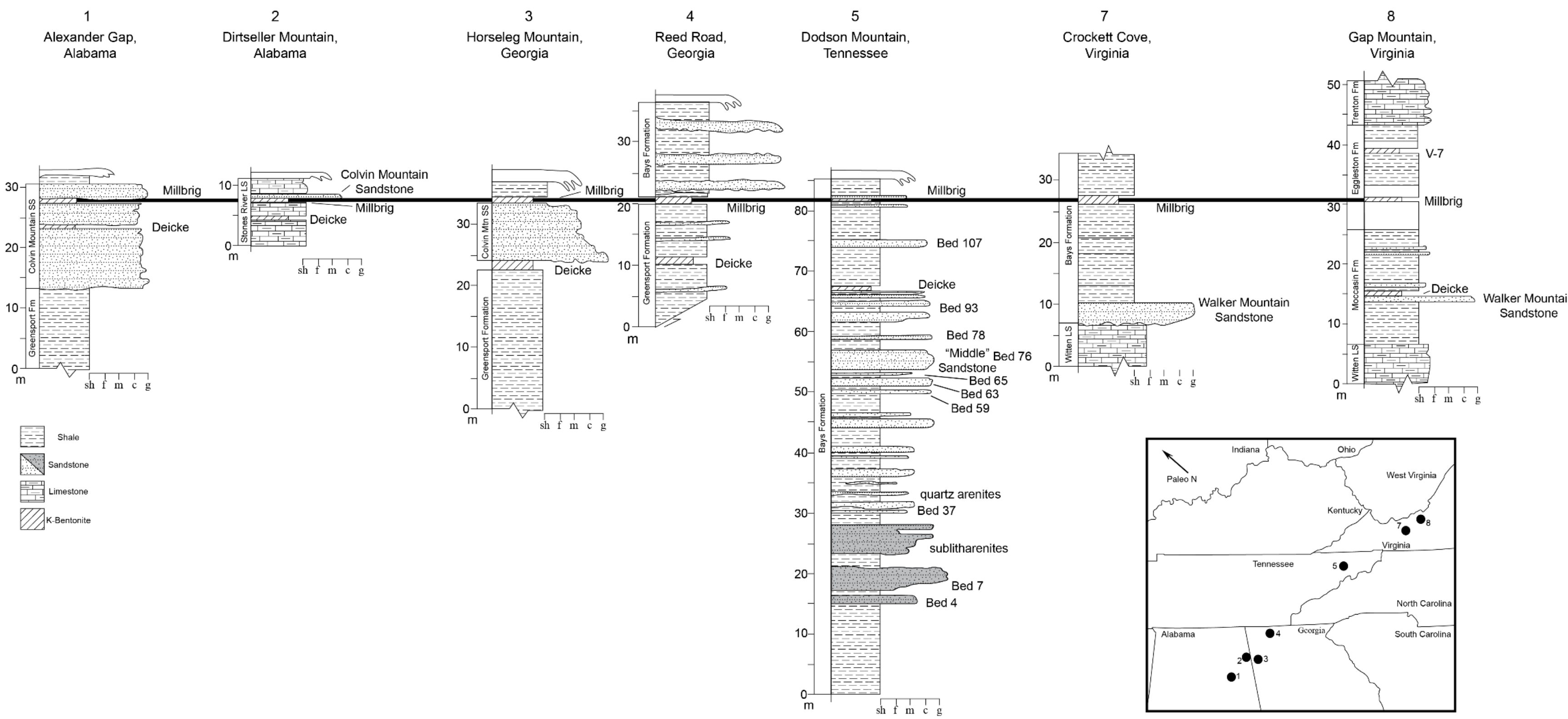

Figure 2. Correlation of sandstones and K-bentonites. Adapted and modified from Herrmann and Haynes (2015).

Colvin Mountain Sandstone

The Colvin Mountain Sandstone, found within the study area in outcrops at Alexander Gap, Alabama; Horseleg Mountain, Georgia; and Dirtseller Mountain, Alabama (Fig. 1) is a quartz-rich sandstone of Middle Ordovician age (Cook, 2010), light to gray, medium- to coarse-grained, occasionally conglomeratic, quartz arenite (Drahovzal and Neathery, 1971; Chowns and McKinney, 1980; Chowns and Carter, 1983). The sandstone varies from moderately to poorly sorted, is non-fossiliferous, and includes sedimentary structures such as bimodal (herringbone) crossbedding, and cut-and-fill (Chowns and Carter, 1983). It was likely deposited in a shallow tide-dominated marine environment (Chowns and Carter, 1983).

At Alexander Gap, this sandstone measures up to 23 m (Jenkins, 1984; Cook, 2010; Herrmann and Haynes, 2015) and it features herringbone crossbedding, indicative of being deposited in a wave or tidal nearshore environment (Jenkins, 1984). At Horseleg Mountain, the sandstone measures ~6 m (Herrmann and Haynes, 2015) and also features herringbone crossbedding (Chowns and Carter, 1983). It is medium to coarse grained in outcrop throughout Alabama (Benson, 1986) and fine to very coarse grained at Horseleg Mountain, Georgia (Cook, 2010). This sandstone overlays the red shales of the Greensport Formation (Benson, 1986; Cook, 2010) in the Alexander Gap and Horseleg Mountain (Fig. 2) sections, and is found on top of the Stones River Limestone (Fig. 2) at Dirtseller Mountain.

The T-3 and T-4 K-bentonite beds, which have been identified as the Deicke and Millbrig, respectively, by Haynes (1994); Kolata et al. (1996); Herrmann and Haynes (2015), are found near the Colvin Mountain Sandstone (Chowns and Carter, 1983). The locations of the Deicke and Millbrig K-bentonites in relation to this sandstone differ depending on the locale. At Alexander Gap, the K-bentonites occur within the Colvin Mountain Sandstone, while at

Dirtseller Mountain the Colvin Mountain Sandstone overlies both K-bentonites (Fig. 2). At Horseleg Mountain, however, the Colvin Mountain Sandstone occurs between the Deicke and the Millbrig (Fig. 2).

Unnamed Pebbly Sandstone

The unnamed pebbly sandstone of the Bays Formation found at Reed Road, Georgia is a coarser quartz arenite than any of the other sandstone samples collected. The stratigraphic relationship between this sandstone and the Deicke and Millbrig K-bentonites is also important to note, as here the K-bentonites are found in redbeds downsection from the oldest pebbly quartz arenites (Bayona, 2003; Bayona and Thomas, 2003, 2006; Herrmann and Haynes, 2015). This unnamed pebbly sandstone was tentatively correlated with the Colvin Mountain Sandstone by a petrographic analysis (Herrmann and Haynes, 2015).

The “Middle” Sandstone

The “Middle” Sandstone is found within the study area at many exposures in the Bays Mountains of northeastern Tennessee (Hergenroder, 1966; Haynes, 1992, 1994; Haynes and Goggin, 1994), including the exposure at the south end of Dodson Mountain. This medium grained sandstone is part of the Bays Formation and measures ~8 m thick at Dodson Mountain (Herrmann and Haynes, 2015). The “Middle” Sandstone is only one of many quartz-rich sandstones interbedded with red shales/siltstones which make up the Bays Formation at this and other locations in the Bays Mountains. The “Middle” Sandstone and associated sandstones of the Bays Formation are relatively clean quartzitic sandstones that are hypothesized to represent ancient beaches (Hergenroder, 1966). The “Middle” Sandstone was deposited through longshore currents which, along with wave action, were instrumental in producing the compositionally

mature sands, as these reworked and winnowed out other material and finer sediment (Hergenroder, 1966).

The Bays Formation is interpreted as the molasse facies of the Blount clastics in northeast Tennessee and southwest Virginia, just as the Greensport Formation and the Colvin Mountain Sandstone at Alexander Gap and Horseleg Mountain represent the molasse facies of the Blount clastics at those locations (Herrmann and Haynes, 2015). The “Middle” Sandstone at Dodson Mountain is stratigraphically below the Deicke and Millbrig K-bentonites (Fig. 2), a major difference compared with Alexander Gap, Dirtseller Mountain, or Horseleg Mountain, where the quartz-rich Colvin Mountain Sandstone encloses, is above, or is in between the K-bentonites, respectively (Fig 2).

Walker Mountain Sandstone

The Walker Mountain Sandstone occurs farther to the northeast in Virginia and West Virginia. It was correlated with the “Middle” Sandstone member of the Bays Formation by Hergenroder (1966), agreeing with the previous study by Butts and Edmundson (1943). The Walker Mountain Sandstone is a thick-bedded, grey, quartz-rich sandstone (Butts and Edmundson, 1943) and generally thickens and coarsens towards the present-day eastern margin of the basin (Haynes and Goggin, 1993). The very sharp contact between the Walker Mountain Sandstone and the underlying finer grained sandstone, siltstone, and limestone is an erosional unconformity (Haynes and Goggin, 1993) (see Fig. 3). Figure 3 shows the change in depositional styles of the underlying strata, from ramp-to-basin carbonate sequences (Read, 1980) to clastic sequences, as well as the approximate stratigraphic position of the Millbrig K-bentonite (Haynes, 1992).

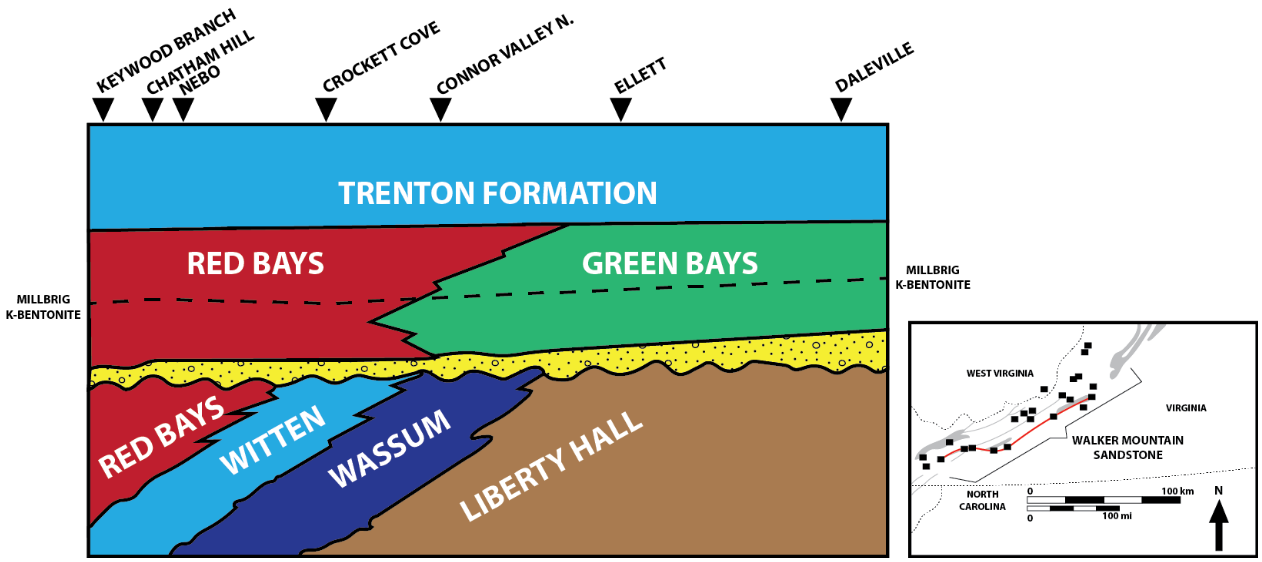

Figure 3. Schematic showing the unconformable relationship between the Walker Mountain Sandstone and the underlying strata along strike at locations in southwestern Virginia. Modified from Haynes and Goggin (1994), Fig. 8.

The Walker Mountain sands are believed to have been derived from reworked alluvial sands that were transported into the basin by rivers that flowed across exposed ramp and basin margin carbonate sediments (Haynes and Goggin, 1993). The alluvial sands are inferred to be sourced from the erosion and weathering of Lower Paleozoic passive margin sedimentary rocks and low-grade metamorphic and igneous rocks from the tectonic highlands to the (present-day) southeast (Haynes and Goggin, 1993). Bimodal textures suggest that the sands were also reworked by eolian processes in some areas, and the presence of shell fragments in some samples indicate the sands were further reworked in a nearshore marine to beach environment (Haynes and Goggin, 1993). The compositionally mature sands of the Walker Mountain Sandstone were probably produced over time as longshore currents sorted and washed the sand continuously (Haynes and Goggin, 1993). Marine fossil fragments were incorporated at this time, and migrating sand waves produced crossbedding (Haynes and Goggin, 1993).

In the study area, the Walker Mountain Sandstone was collected at Nebo, Virginia; Crockett Cove, Virginia; Ellett, Virginia; Gap Mills, West Virginia; and at McGraw Gap,

Virginia (Fig.1). At Crockett Cove, the Walker Mountain Sandstone is ~6.5 m thick and unconformably overlies the Witten Limestone (Haynes, 1992; Haynes and Goggin, 1993). At Ellett, the Walker Mountain Sandstone is a very coarse grained to conglomeratic quartz and sublithic arenite (Haynes and Goggin, 1993). It unconformably overlies dark gray calcareous silty shales of the Liberty Hall Formation, and it exhibits some crossbedding in sandstone beds above the conglomerate beds (Haynes and Goggin, 1993). The unconformity is correlated with the unconformity seen at Crockett Cove on the basis of the stratigraphic relations of the Millbrig K-bentonite, the Walker Mountain Sandstone, and the unconformity (Haynes and Goggin, 1993). Another important location where the Walker Mountain Sandstone is found is at Gap Mountain, Virginia. Here, the Walker Mountain Sandstone is only ~0.6 m thick and is found within the redbeds of the Moccasin Formation (Haynes and Goggin, 1993). The contact between the Moccasin Formation and the Witten Limestone can be observed here (Fig. 2). This contact between shale and limestone facies is missing at both Ellett and Crockett Cove.

The relation between the Walker Mountain Sandstone and the Deicke and Millbrig K-bentonites is very similar to what is observed with the “Middle” Sandstone and those two K-bentonites at Dodson Mountain, Tennessee. The Walker Mountain Sandstone occurs stratigraphically below the K-bentonites at all studied outcrops throughout Virginia and West Virginia (Fig. 2).

A-type Subduction Model

A-type or Ampferer subduction, as defined by Bally (1975) during the advent of plate tectonics, is used to describe subduction zones where continental lithosphere is being subducted (Hodges et al., 1982), as opposed to B-type or Benioff subduction, which describes subduction of oceanic lithosphere (Bally, 1975).

The Taconic Orogeny is the mountain building event that occurred during the Middle to Late Ordovician associated with the closing of the Iapetus Ocean (Higgins et al., 1988). The Iapetan closure is attributed to a B-type subduction zone that formed off the coast of the Laurentian continent (Plank and Schenck, 1998). This subduction zone led to the formation of a volcanic arc along the eastern margin of the Laurentian continent (Plank and Schenck, 1998). This volcanic-arc (450-470 Ma) eventually collided with the eastern margin of the Laurentian continent and created the Taconic highlands (Fig. 4) (Coler et al., 2000; Eriksson et al., 2004). As a result of this orogeny, a foreland basin and associated accretionary wedge (Fig. 5) (Mussman and Read, 1986; Eriksson et al., 2004) formed between the Laurentian margin and the accreted volcanic arc. As the Taconic highlands were being created, sediment was accumulating within the foreland basin as the volcanic arc was deformed and the easternmost Laurentian continent subducted beneath it via an A-type subduction zone (e.g. Shanmugam and Lash, 1982; Hatcher, 2005).

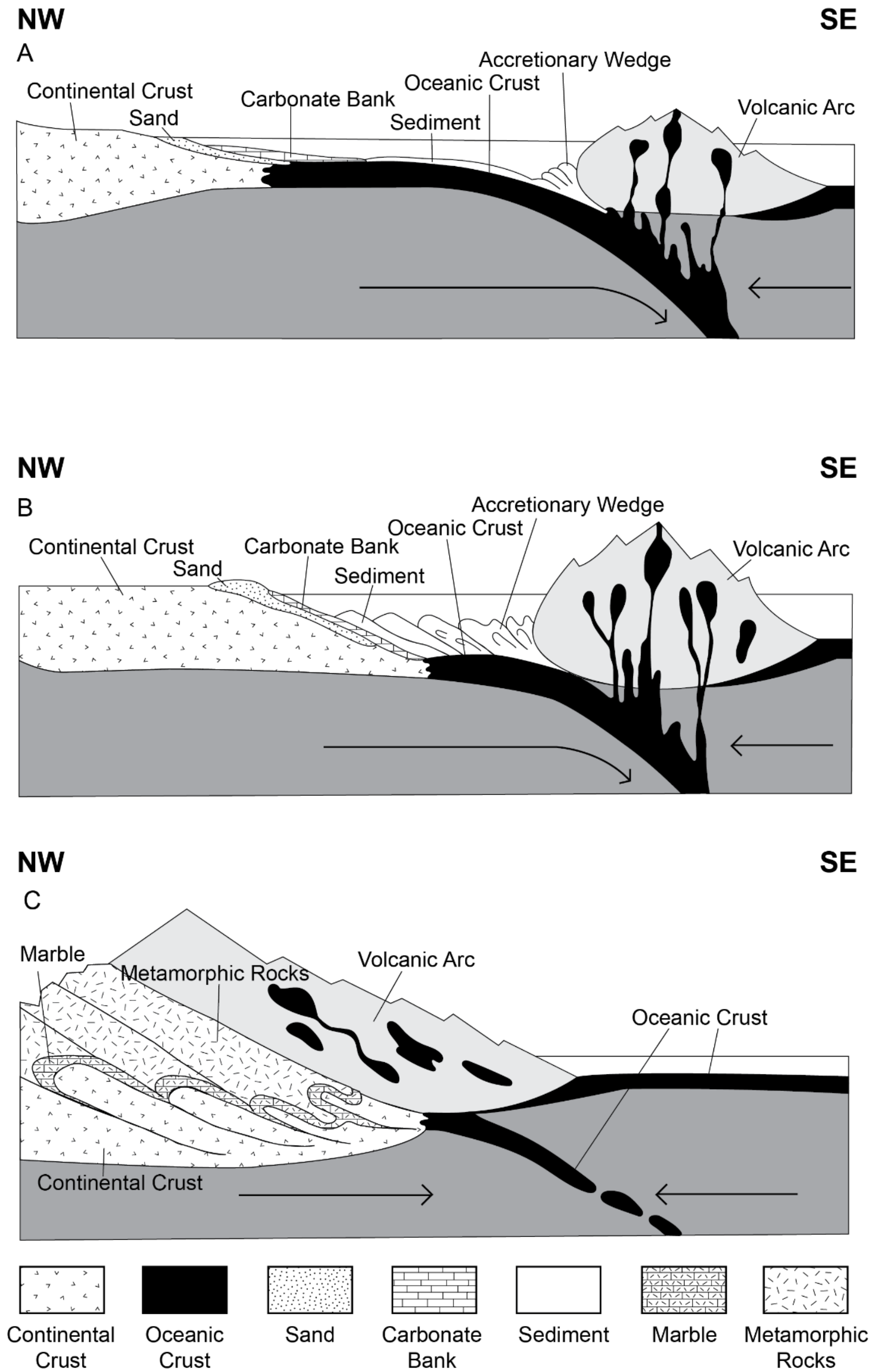

Figure 4. Illustration showing Laurentian margin of eastern North America at (A) 543 Ma, (B) 500 Ma, and (C) 440 Ma, showing formation of volcanic arc and later collision [redrafted from Plank and Schenck (1998)].

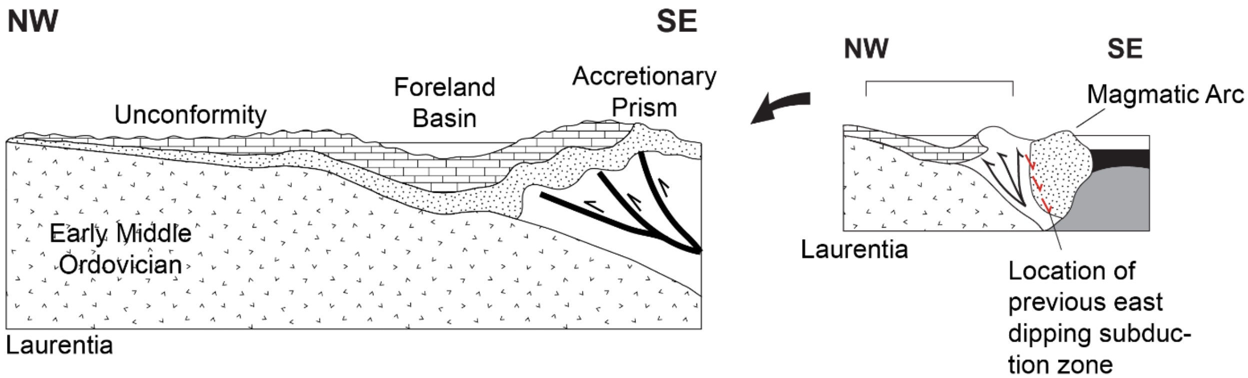

Figure 5. Schematic showing proposed accretionary wedge (or prism) and relation with the foreland basin [redrafted and modified from Mussman and Read (1986)].

Back-arc Model

Another model proposed for the Taconic Orogeny is a combined A-type subduction for the northern part of the Appalachians Mountains and a B-type subduction for the southern part with an intervening transform boundary to account for the polarity reversal of the subduction zones (Tull et al., 2014; Barineau et al., 2015). This model agrees with the generally accepted model that the northern part of the Appalachian Mountains is an A-type, collisional orogeny (Chapple, 1973; Robinson and Hall, 1980; Rowley and Kidd, 1981; Stanley and Ratcliffe, 1983, 1985) but challenges the notion that the A-type model can be used to explain part of the southern Appalachians (Shanmugam and Lash, 1982; Hatcher, 1987; Higgins et al., 1988; Drake et al., 1989; Hatcher, 2005; Hatcher et al., 2007; McClellan et al., 2007). This combined A-type, B-type model proposes a back-arc basin for the southern Appalachians named the Wedowee-Emuckfaw-Dahlonega (WED) basin (Fig. 5 and 6) and uses the WED basin system to explain how this area was linked to accretionary orogenesis rather than to collisional orogenesis, as defined by Cawood and Buchan (2007) (Tull et al., 2014; Barineau et al., 2015). In accretionary orogens, crustal growth and metamorphism are involved in a system of long-term subduction and

plate convergence, without colliding continental blocks or large-scale buoyant lithosphere (Cawood and Buchan, 2007).

The key piece of evidence used against the A-type subduction model is the lack of a forearc and accretionary prism in the southern Appalachian area, which is different from what is seen in collisional, A-type orogens (Barineau et al., 2015). As an example of an A-type orogen, the modern-day subducting margin of Australia in Timor and western Papua New Guinea (Harris et al., 1998; Audley-Charles, 2004; Cloos et al., 2005; Harris, 2006; Keep and Haig, 2010) includes a forearc and accretionary prism between the foreland basin (Timor Trough) and the associated volcanic arc (Java-Sumatra and eastern extension).

Furthermore, Barineau et al. (2015) state that the WED basin would have been located in an area that would have been able to receive both volcanic-Ordovician units and Grenville-aged sediments (Fig. 6 and 7), and they hypothesize that the precursor tephras of the Deicke and Millbrig K-bentonites originated “in the vicinity of” the WED basin, as these get thicker towards a palinspastic location between Pennsylvania and Alabama (Kolata et al., 1998). Barineau et al. (2015) also hypothesize that a genetic relationship existed between the Blount basin of the southern Appalachian foreland (Taconic synorogenic clastic wedge) and the WED basin, referencing the close proximity of the two basins, the contemporary sedimentation of both basins, and the fact they both experienced similar-aged silicic volcanic systems (Fig. 6 and 7). The oldest K-bentonites found within the Blount sequence are Darriwillian in age (Shanmugam and Walker, 1980; Kolata et al., 1996; Bayona and Thomas, 2006; Leslie, 2012), which is contemporary with bimodal volcanic suites in the WED basin (Barineau et al., 2015). The molasse sequences would have been deposited within the Blount basin, located just west (present-day) of the WED basin, during the Middle-Late Ordovician (Barineau et al., 2015). In

this model, it is suggested that the Blount clastic wedge formed in a retroarc basin landward (toward the Laurentian continent) of the WED basin, having developed due to inversion of Neoproterozoic rift-related faults (Bayona, 2003; Bayona and Thomas, 2003, 2006; Barineau et al., 2015).

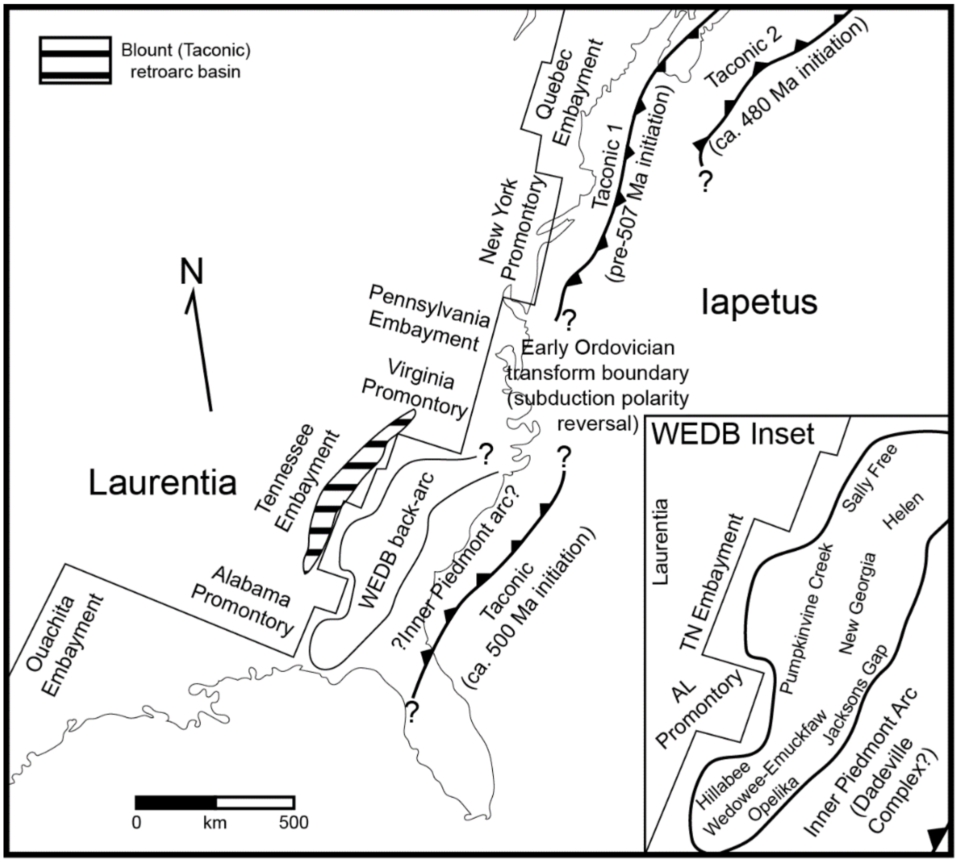

Figure 6. Back-arc model for the Taconic Orogeny. Map shows position of the Blount Basin in relation with the Wedowee-Emuckfaw-Dahlonega Basin. Also shown is the hypothesized transform fault between the two opposite dipping subduction zones. Modified from Tull et al. (2014), with contributions from Thomas (1991) and van Staal et al. (2007).

Samson et al. (1989) obtained Nd and Sr isotopic data from Ordovician K-bentonites, including the Deicke. Initial $^{87}Sr/^{86}Sr$ ratios versus initial $^{E}{}_{Nd}$ data show that the K-bentonites are not primitive, mantle-derived tephras, as MORB or island arc volcanics are normally. As an alternative, the isotopic data, including inherited Pb content taken from zircons, are consistent

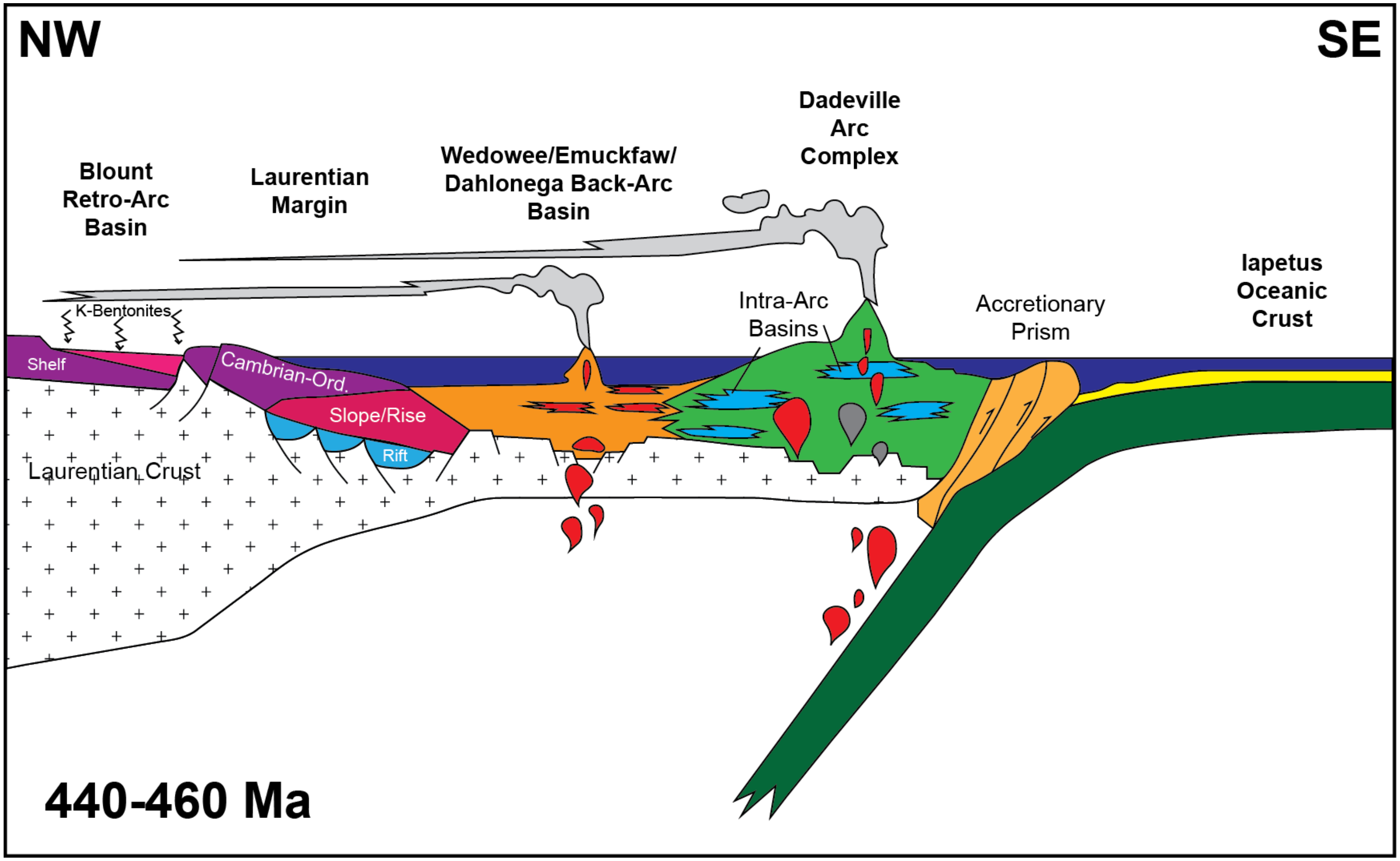

Figure 7. Cross section showing the Blount Basin in relation to the WED Basin. According to this model, the Blount Basin formed as a retro-arc basin due to inversion of Neoproterozoic rift faults (Barineau et al., 2015), and the K-bentonites were sourced from extended continental crust (Tull et al., 2014; Barineau et al., 2015). The thickness of this crust becomes an important factor in the accuracy of this model, as Hughes and Mahood (2008) described a positive correlation between crustal thickness and silica content. Figure redrafted from Tull et al. (2018).

with some continental crustal source melting and interaction with the melt (Samson et al., 1989; Carey et al., 2009).

The studies by Samson et al. (1989) and Carey et al. (2009) conclude that certain constraints can be placed on the possible source area of the K-bentonites, including an area underlain by Proterozoic continental crust, which is required in their model to account for the inherited zircons that were present. Other studies have also concluded that the volcanic arc from which the Deicke and Millbrig K-bentonites were erupted very likely had a continental crust component (Huff et al., 1992; Kolata et al., 1996, 1998; Haynes et al., 2011). Huff et al. (1992) used trace element data to conclude that the Millbrig K-bentonite was derived from dacitic to rhyolitic magma and implied that the felsic character of the K-bentonite was consistent with convergent plate-margin settings, where a major component of the parent magma comes from partial melting of continental crust. Kolata et al. (1998) stated that the Hagan K-bentonite complex, a sequence of K-bentonite beds (including the Deicke and Millbrig K-bentonites) found across much of eastern North America including in the southern Appalachian Mountains, were sourced from one or more magmatic centers positioned on continental crust. The study states that the ash was derived from a felsic calc-alkaline magmatic suite ranging from andesite through rhyodacite and trachyandesite to rhyolite (Kolata et al., 1998), according to the chemical analyses of Huff et al. (1992); Kolata et al. (1996). This data validates not only the felsic nature of the parent magmas, but the inclusion of continental crust, which could be linked to incoming microcontinents or to the Laurentian margin (Kolata et al., 1998). This inclusion of crustal material is supported by findings from Haynes et al. (2011). In their study, biotites from Ordovician K-bentonites (including the Deicke and Millbrig K-bentonites) and biotites from various Cenozoic volcanics were compared based on their elemental variations, and the authors

concluded that the Ordovician K-bentonites are very likely to be the products of explosive, caldera-forming volcanism (Haynes et al., 2011).

Grenville Orogeny

The Granite-Rhyolite igneous province (~1300-1500) was an orogenic interval which concluded during the collision of Laurentia and Amazonia (Spencer and Kirkland, 2015) which is known as the Grenville orogeny (Rivers et al., 2012). The cratonic sedimentary basins associated with the Grenville orogeny record sedimentary layers which reflect the active convergent margin before the collisional Grenville orogeny, during the construction of Rodinia, and basins formed after Rodinia formed and during its breakup (Spencer and Kirkland, 2015).

Focusing on the southern Appalachians, the sedimentary successions that antecede Rodinia include Appalachian inliers (Carrigan et al., 2003; Ownby et al., 2004); which include zircon grains of >1500 Ma derived from the crystalline basement of the cratonic interior as well as zircons grains aged ~1200-1500 Ma concomitant with subduction zone magmatism anteceding the Grenville Orogeny (Spencer and Kirkland, 2015).

An example of sedimentary deposition during the Grenville Orogeny is given by the Middle Run Formation which, according to Schneider Santos et al. (2002), demonstrates a cratonic foreland setting. The Middle Run Formation is not exposed at the surface, and it has been sampled only from the subsurface in drill core ~50 km from the Grenville orogenic front in southwestern Ohio (Schneider Santos et al., 2002). The Middle Run is hypothesized to have been deposited within the foreland of the collisional orogeny (Cawood et al., 2007). Detrital zircons from the Middle Run Formation ranged in age from 1030-1982 Ma, however the majority (80-90%) had ages found within the Grenville province (Schneider Santos et al., 2002). During the

Grenville orogeny, sedimentation was also occurring at the Midcontinental Rift (in the upper Midwest region of the United States), in which Craddock et al. (2013) found the youngest zircon ages to be ~950 Ma (Spencer and Kirkland, 2015).

Finally, sedimentation which occurred after the formation and breakup of Rodinia include successions deposited within failed intracratonic rift basins such as the Dahlonega gold belt, Sauratown Mountains window, and the Smith River allochthon (Bream et al., 2004; Carter et al., 2006), all in the Eastern Blue Ridge of the Appalachian Mountains. Sedimentary successions documenting the rift to drift transition, for instance the Rome Formation of the Southern Appalachians (Thomas, 2004), followed thereafter (Spencer and Kirkland, 2015).

METHODS

Sampling

Nineteen sandstones of Late Ordovician age were sampled throughout the southeastern Appalachian Mountains. These sandstones were collected from 11 outcrops in Alabama, Georgia, Tennessee, West Virginia, and Virginia (Fig. 1), which represent the molasse sequences deposited within the foreland basin (Haynes and Goggin, 2011). Five samples of the Colvin Mountain Sandstone were collected (one at Alexander Gap, Alabama; three at Horseleg Mountain, Georgia; and one at Dirtseller Mountain, Alabama). An unnamed pebbly sandstone was collected at Reed Road, Georgia. Seven different sandstone samples, including the "Middle" Sandstone Member, were collected from the Bays Formation at Dodson Mountain, Tennessee. And six samples of the Walker Mountain Sandstone were collected (at Nebo, Virginia; Crockett Cove, Virginia; Gap Mountain, Virginia; Ellett, Virginia; Gap Mills, West Virginia; and McGraw Gap, Virginia). The Deicke and especially the Millbrig K-bentonites were used as datums because they are the most extensive of the many ash layers found in this stratigraphy in the eastern United States (Kolata et al., 1998), and within the molasse redbed sequences, those two are in fact the only K-bentonites that have been identified and correlated along strike (Haynes, 1992, 1994; Haynes and Goggin, 2011; Herrmann and Haynes, 2015). Those K-bentonites have previously been used to correlate the sandstones within the Blount foreland basin, as shown in Figure 2, where sections in the Blount molasse are correlated along depositional strike from Virginia to Alabama (e.g. Haynes, 1994; Haynes and Goggin, 2011; Haynes et al., 2011; Herrmann and Haynes, 2015).

Zircon Separation and Imaging

Sandstone samples were fragmented using high voltage pulsed power discharges to disaggregate the rocks (SELFRAG) (Liu et al., 2012). The sandstones were all placed in the SELFRAG Lab individually at a voltage of 175 kV, pulse frequency of 5 Hz, pulse number of 500, and working electrode gap of 20 mm. After fragmentation, samples were sifted through 125 µm and 63 µm U.S.A. standard test sieves. The > 125 µm fractions were archived, whereas the < 125 µm – 63 µm fractions were further sorted via heavy liquid density separation, using the compound sodium polytungstate at a density of ~2.8 g/cm^3. The lighter material (< 2.8 g/cm^3) was archived, and the heavier material (> 2.8 g/cm^3) was set aside for further analysis.

Zircons were handpicked from the heavier material (> 2.8 g/cm^3) using a Leica M125 stereomicroscope and a one-bristle paint brush. Zircon mineral standards Plešovice – 337.1 ± 0.2 Ma (Sláma et al., 2008; Horstwood et al., 2016), 91500 – 1063.51 ± 0.39 Ma (Wiedenbeck et al., 1995; Horstwood et al., 2016), and Temora-2 – 416.78 ± 0.33 Ma (Black et al., 2004) were also picked. The Plešovice zircon standard comes from a potassic granulite found in the Plešovice quarry, located on the eastern part of the Blanský les granulite body, in the southern Bohemian Massif, Czech Republic (Sláma et al., 2008). 91500 is found at Kuehl Lake, Renfrew County, Ontario, Canada; with the predominant rock type being porphyroblastic syenite gneiss, showing cross-cutting by sheets or sills of syenite pegmatite (Hewitt, 1953; Wiedenbeck et al., 1995). The Temora-2 zircon crystallized within the Middledale Gabbroic Diorite, which is found at the Paleozoic Lachlan Orogen of Eastern Australia (Wormald, 1993; Black et al., 2004).

Košler and Sylvester (2003) stated that prior studies utilizing U-Pb dating of detrital zircon grains for sedimentary provenance work (Morton et al., 1996; Whitehouse et al., 1997; e.g. Fernández-Suárez et al., 2000) showed that in order to be confident that all major

sedimentary sources have been identified, precise and accurate U-Pb and Pb-Pb isotopic ages of 80-100 zircon grains must be analyzed per sample (Dodson et al., 1988). In order to improve the resolution of the data set, double the number of suggested zircon grains were analyzed. Once ~200 zircons were picked for each sample (as well as ~5 zircons from each standard) and cast in epoxy, the plugs were ground and polished in order to expose the inner part of the zircon grains. Polished plugs were then placed inside a Relion Industries cathodoluminescence (CL) detector at a pressure of ~40 mTorr, beam current of 0.5 mA, and beam voltage of ~-5 KV. Using the same Leica M125 stereomicroscope, the epoxy plugs were imaged in order to view any cores, growth rings, or zoning within the zircons.

After cathodoluminescence imaging was completed, epoxy mounts were coated with ~20 nanometers of carbon using a Leica EM ACE 600 coating system house in the Shared Instrument Facility (SIF) at Louisiana State University. Zircon mount reconnaissance was performed with a JEOL JXA-8230 electron probe microanalyser (EMP) equipped with three wavelength-dispersive spectrometers (WDS), secondary electron (SE) and backscatter electron (BSE) detectors, and an energy dispersive X-ray spectrometer (EDX). Standard operating conditions used for zircon reconnaissance, to identify internal structure, inclusions, and physical defects, were an accelerating voltage of 15 kV and a beam current of 20 nA; these conditions provided ample illumination in BSE for discerning zircon from other silicates, oxides, and phosphate accessory minerals.

Laser Ablation (U-Pb Geochronology)

The plugs were then placed inside a CETAC Technologies LSX-213 G2 laser ablation system connected to a Thermo Scientific iCAP Q-ICP-MS. Argon and helium gas were used to

carry the ablated material from the laser ablation system into the mass spectrometer. The laser was shot using the two different sets of parameters (Table 1) depending on zircon size.

The runs were started by ablating the primary standard (Plešovice) four times, followed by five ablations of the secondary standard (91500 or Temora-2), followed by three ablations of the primary standard. From then on in each analytical run, the primary standard was ablated four times between every 20 sandstone detrital zircons. To conclude the run, the secondary standard was ablated five times, followed by three ablations of the primary standard. Standards were ablated before, during, and after the run to account for instrument drift and to calibrate ages. The data from the runs were then reduced using the software Wavemetrics Igor Pro™ (v. 6.37) with the add-in Iolite (v. 2.5) (Hellstrom et al., 2008). Once reduced, the U-Pb ages were plotted as Kernel Density Estimator (KDE) plots using the R software (R Core Team, 2017) with the R package Provenance (Vermeesch et al., 2016). All $^{207}Pb/^{235}U$ ages reported herein are less than 20% discordant, calculated using the ratio of $^{206}Pb/^{238}U$ and $^{207}Pb/^{235}U$ (Spencer et al., 2016).

Table 1. Laser Ablation Parameters

Spot Size	25 µm (13 samples)	10 µm (3 samples)
Laser Energy	10%	50%
Laser Shot Frequency	20 Hz	20 Hz
Shutter Delay	10 s	10 s
Burst Count	700	700
He Gas Flow	~600 mL/min	~600 mL/min

RESULTS

The detrital zircon $^{207}Pb/^{235}U$ ages showed a great range, with the youngest grain being ~435 Ma and the oldest reaching an age of ~3190 Ma. All samples analyzed had significant age concentrations between ~900-1300 Ma and 1300-1500 Ma, while only two samples in the southern part of the study area had significant age concentrations between ~440-490 Ma.

Alexander Gap, Horseleg Mountain, Dirtseller Mountain, and Reed Road Sections

$^{207}Pb/^{235}U$ ages for detrital zircons in the Colvin Mountain Sandstone at the southernmost locations in the study area show a majority of Grenville/Keweenawan ages (900-1200 Ma), ranging from 62.6% at the southernmost section (Alexander Gap) to 46.1% at the Horseleg Mountain-Fine stratigraphic horizon (Fig. 8, Table 2). The Grenville/Keweenawan ages stay relatively the same from Alexander Gap to the lowest sampled section of Horseleg Mountain. Here, these ages decrease in quantity going upsection (61.1% to 45.8%). There is not much change from the highest sampled stratigraphic horizon of Horseleg Mountain to Dirtseller Mountain (46.1%) (Table 2).

Conversely, the opposite trend is seen within the Taconic ages (400-490 Ma) of the Colvin Mountain Sandstone. The percentage of these ages increases from almost zero at Alexander Gap (0.5%) to a substantially higher amount at Dirtseller Mountain (31.5%). The percentage of Taconic-aged zircons for the Colvin Mountain Sandstone at Dirtseller Mountain is the highest seen of any sample in this study (Table 2).

It is also important to note that the unnamed pebbly sandstone of the Bays Formation at Reed Road had the youngest cluster of zircons of any sample in the study (~390-420 Ma). Percentages of Granite-Rhyolite (1200-1500 Ma), Yavapai-Matzal (1600-1800 Ma), Trans-

Hudson/Penokean (1800-1900), and Superior Craton (2600-2800 Ma) ages within these southernmost samples are given in Table 2.

Dodson Mountain Section

A more detailed analysis of the Dodson Mountain section of Tennessee was conducted, in which seven different sandstone layers were analyzed. Grenville/Keweenawan (900-1200 Ma) and Granite-Rhyolite (1200-1500 Ma) ages held the highest percentages of abundance in these samples (Fig. 9, Table 3). Grenville/Keweenawan abundances ranged from 36.4% in Bed 4 to 60.8% in Bed 76, while Granite-Rhyolite ages ranged from 34.7% in Bed 7 to 55.0% in Bed 4 (Table 3). No real trend was identified on these ages.

Only two Taconic ages (440-490 Ma) were discovered in all of the Dodson Mountain section, in Beds 37 and 78, equating to 1.0% and 0.8% abundances respectively. There is a stark difference in the lack of abundance of Taconic ages in this section versus samples from the southern sections at Horseleg Mountain and Dirtseller Mountain (Fig. 8, Table 2). Percentages of Yavapai-Matzal (1600-1800 Ma), Trans-Hudson/Penokean (1800-1900), and Superior Craton (2600-2800 Ma) ages within these samples from the Dodson Mountain section are given in Table 3.

Nebo, Crockett Cover, Gap Mountain, Ellett, Gap Mills, and McGraw Gap Sections

Detrital zircons from samples of the Walker Mountain Sandstone were collected at six different sections in Virginia and West Virginia. Again, Grenville/Keweenawan (900-1200 Ma) and Granite-Rhyolite (1200-1500 Ma) ages dominate these samples (Fig. 10, Table 4). Starting at Nebo, the first four Walker Mountain sections (Nebo, Crockett Cove, Gap Mountain, and Ellett) have Grenville/Keweenawan abundances that range from 66.9% at Nebo to 53.6% at Crockett

Cove, and Granite-Rhyolite ages that range in abundance from 32.0% at Nebo to 37.9% at Ellett (Table 4).

The two Walker Mountain Sandstone samples located furthest to the north, at Gap Mills and McGraw Gap, show different abundances for Grenville/Keweenawan and Granite-Rhyolite ages. Gap Mills had 8.5% Grenville/Keweenawan ages, with 67.8% Granite-Rhyolite ages, while McGraw Gap showed 80.8% and 73.1%, respectively. It is important to note that these two samples had a severely smaller sample size than the others (Table 4).

Only two zircons in these six Walker Mountain Sandstone samples were of Taconic age, and those were found in the samples from Gap Mountain and McGraw Gap, accounting for 1.0% and 1.9% of their respective abundances. Percentages of Yavapai-Matzal (1600-1800 Ma), Trans-Hudson/Penokean (1800-1900), and Superior Craton (2600-2800 Ma) ages within all of the Walker Mountain Sandstone samples are given in Table 4.

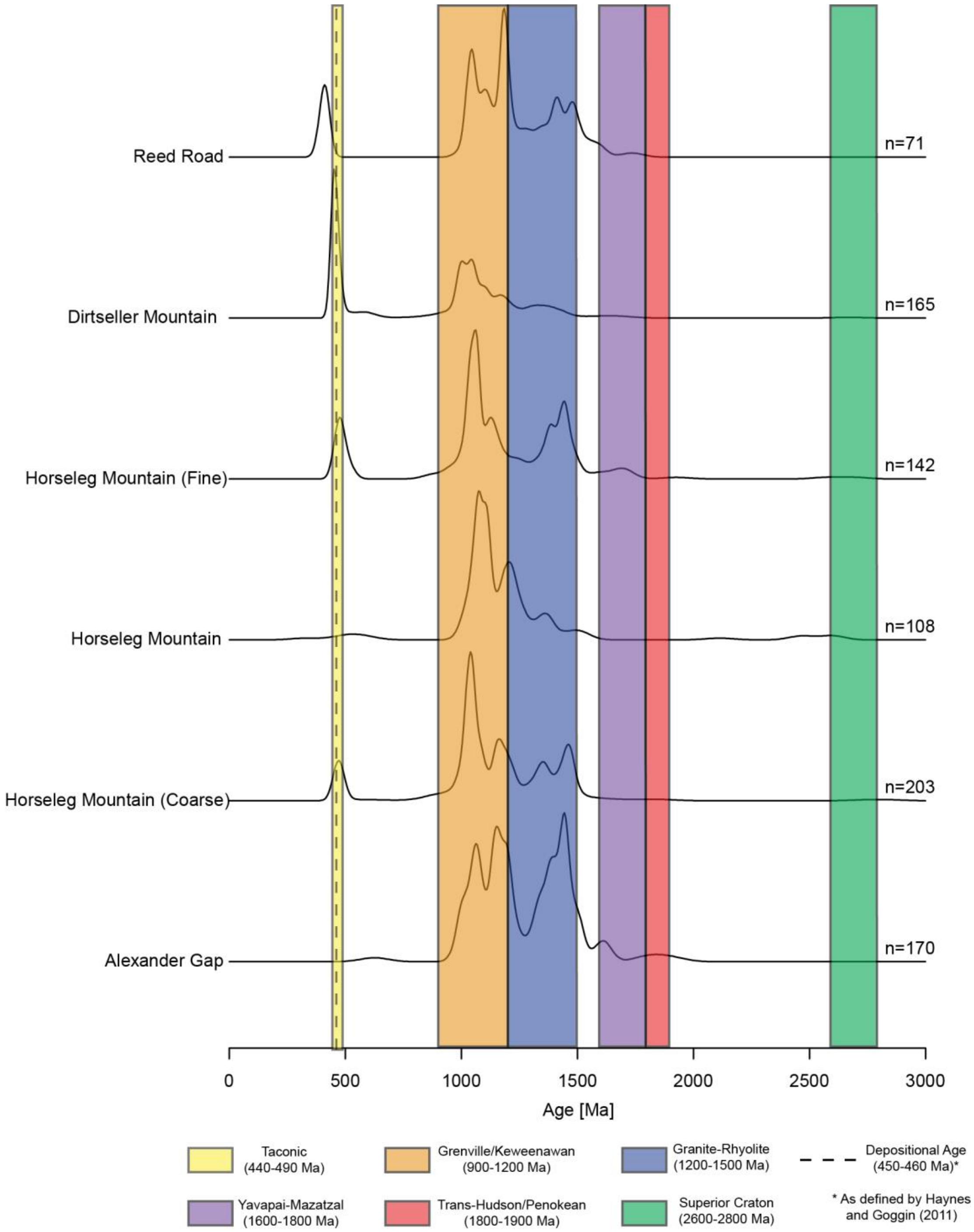

Figure 8. KDE plot showing U-Pb ages for zircons in the Colvin Mountain Sandstone from Alexander Gap, Alabama; Horseleg Mountain, Georgia; and Dirtseller Mountain, Alabama, as well as the unnamed pebbly sandstone from Reed Road, Georgia.

Table 2. Table showing percentage of zircon grains in certain age groups for the Colvin Mountain Sandstone from Alexander Gap, Horseleg Mountain, and Dirtseller Mountain, as well as percentages for the unnamed pebbly sandstone from Reed Road.

Location/Bed	Taconic (400-490 Ma)	Grenville/ Keweenawan (900-1200 Ma)	Granite-Rhyolite (1200-1500 Ma)	Yavapai-Mazatzal (1600-1800 Ma)	Trans-Hudson/Penokean (1800-1900 Ma)	Superior Craton (2600-2800 Ma)
Reed Road, GA n=71	11.3%	46.5%	35.2%	4.2%	-	-
Dirtseller Mountain, AL n=165	31.5%	46.1%	14.5%	1.8%	-	0.6%
Horseleg Mountain-Fine, GA n=142	9.9%	45.8%	33.1%	4.9%	0.7%	1.4%
Horseleg Mountain-Coarse, GA n=203	7.9%	53.2%	33.0%	1.5%	0.5%	1.0%
Horseleg Mountain, GA n=108	1.9%	61.1%	29.6%	-	-	1.9%
Alexander Gap, AL n=170	0.5%	62.6%	32.3%	1.5%	-	0.5%

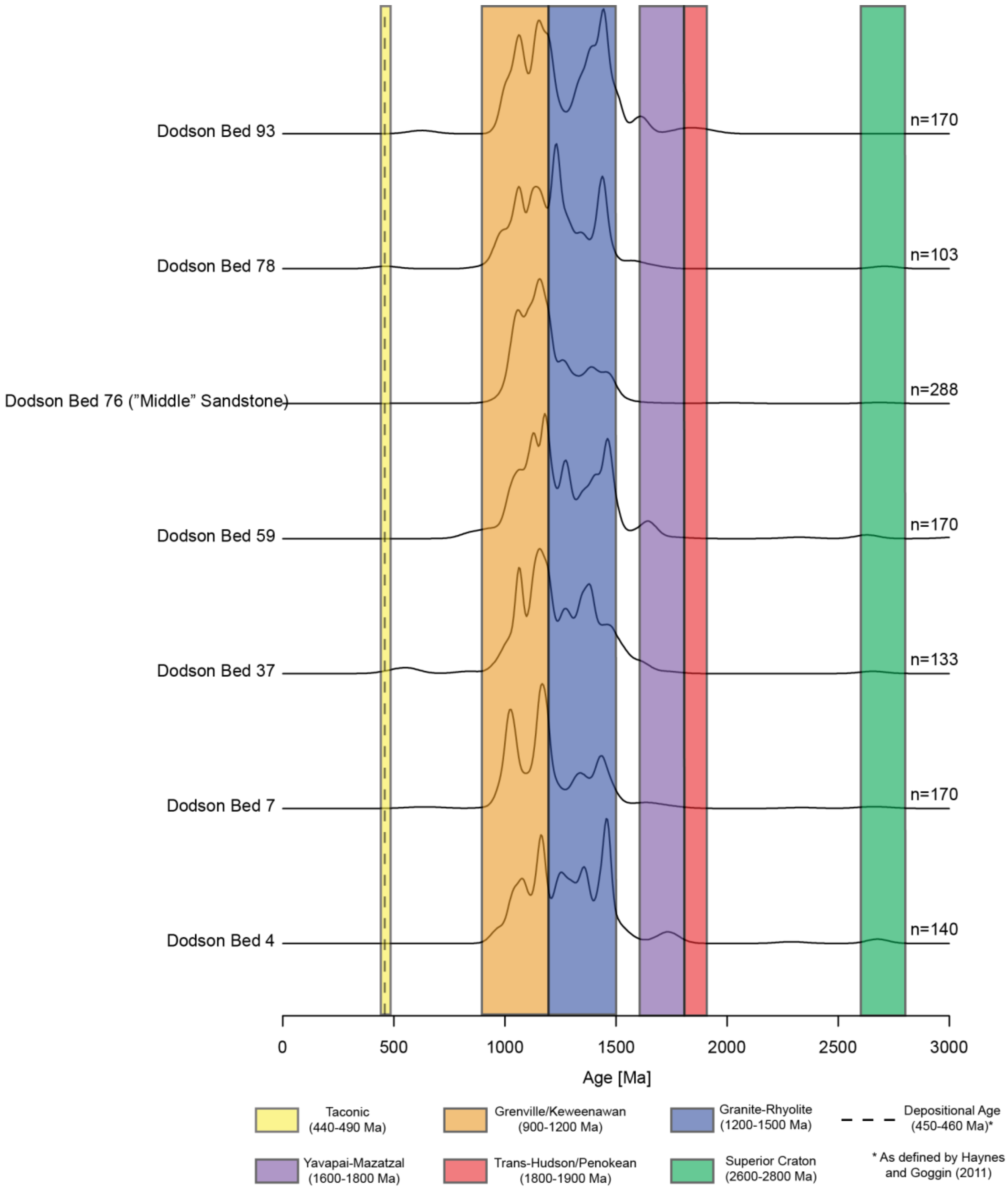

Figure 9. KDE plot showing U-Pb ages for zircons in samples from the Dodson Mountain section, Tennessee. Seven sandstone layers were analyzed, including the "Middle" Sandstone (Bed 76).

Table 3. Percentage of zircon grains in age groups for "Middle" Sandstone and associated sandstone beds from Dodson Mountain.

Location/Bed	Taconic (400-490 Ma)	Grenville/ Keweenawan (900-1200 Ma)	Granite-Rhyolite (1200-1500 Ma)	Yavapai-Mazatzal (1600-1800 Ma)	Trans-Hudson/Penokean (1800-1900 Ma)	Superior Craton (2600-2800 Ma)
Dodson Mountain, TN-Bed 93 n=170	-	43.5%	48.2%	4.1%	2.4%	-
Dodson Mountain, TN-Bed 78 n=103	1.0%	44.7%	49.5%	2.9%	-	1.0%
Dodson Mountain, TN-Bed 76 ("middle sandstone") n=288	-	60.8%	35.4%	0.7%	-	0.7%
Dodson Mountain, TN-Bed 59 n=170	-	42.9%	47.1%	4.7%	-	1.2%
Dodson Mountain, TN-Bed 37 n=133	0.8%	42.1%	45.1%	3.8%	-	0.8%
Dodson Mountain, TN-Bed 7 n=170	-	57.6%	34.7%	3.5%	-	1.2%
Dodson Mountain, TN-Bed 4 n=140	-	36.4%	55.0%	4.3%	-	1.4%

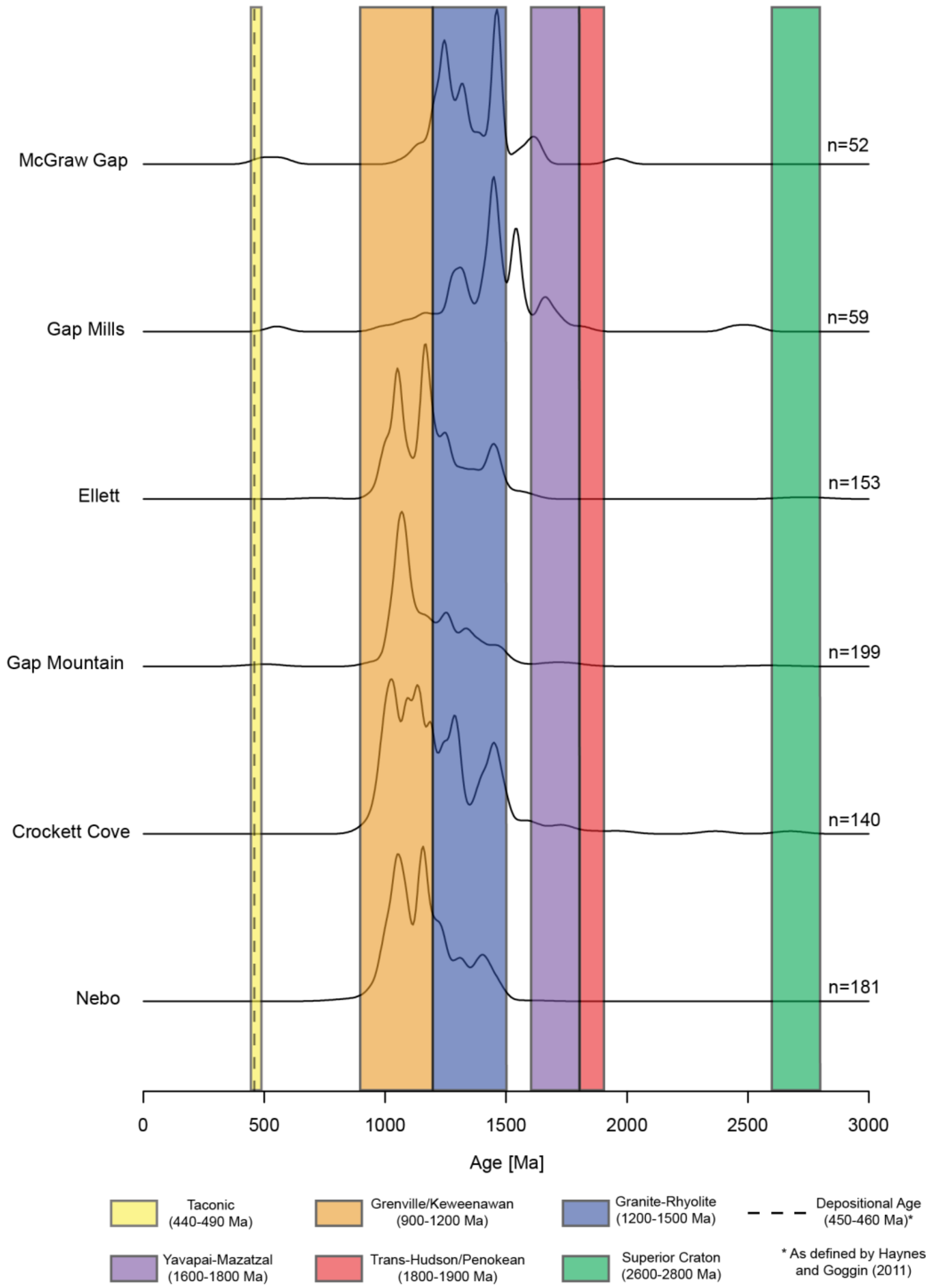

Figure 10. KDE plot showing U-Pb ages of zircons in the Walker Mountain Sandstone from Nebo, Virginia; Crockett Cove, Virginia; Gap Mountain, Virginia; Ellett, Virginia; Gap Mills, West Virginia; and McGraw Gap, Virginia

Table 4. Table showing percentage of zircon grains in certain age groups for the Walker Mountain Sandstone from Nebo, Crockett Cove, Gap Mountain, Ellett, Gap Mills, and McGraw Gap.

Location/Bed	Taconic (400-490 Ma)	Grenville/ Keweenawan (900-1200 Ma)	Granite-Rhyolite (1200-1500 Ma)	Yavapai-Mazatzal (1600-1800 Ma)	Trans-Hudson/Penokean (1800-1900 Ma)	Superior Craton (2600-2800 Ma)
McGraw Gap, VA n=52	1.9%	80.8%	73.1%	7.7%	1.9%	-
Gap Mills, WV n=59	-	8.5%	67.8%	18.6%	-	-
Ellett, VA n=153	-	57.5%	37.9%	1.3%	-	1.3%
Gap Mountain, VA n=199	1.0%	58.8%	34.2%	2.5%	0.5%	-
Crockett Cove, VA n=140	-	53.6%	37.1%	3.6%	0.7%	0.7%
Nebo, VA n=181		66.9%	32.0%	0.6%	-	-

DISCUSSION

Detrital Zircons Age Interpretations

It is important to note that the unnamed pebbly sandstone from Reed Road, Georgia should be omitted from this data set. The ages of detrital zircons from this sandstone give us a maximum depositional age of 392 ± 19 Ma, making this sandstone only as old as the Middle Devonian and not Ordovician in age.

A recent provenance study by Cleveland et al. (2015) focused on sandstones in this same region and showed two dominant age ranges of detrital zircons: one from ~980-1300 Ma and the second from ~1300-1500 Ma. These are compatible with ages seen throughout the Grenville and Granite-Rhyolite provinces, respectively (Park et al., 2010). Results from the current research match the results from Cleveland et al. (2015), also showing ages normally seen throughout the Grenville and Granite-Rhyolite provinces.

Older ages of ~1600-1800 Ma, ~1800-1900 Ma, and ~2600-2800 Ma, which correlate to the Yavapai-Mazatzal, Trans-Hudson/Penokean, and Superior Craton provinces respectively, have also been found throughout the Appalachian region (Thomas et al., 2004; Park et al., 2010). Initial transgression of passive margin sandstones from further inland to the Laurentian Iapetus margin range from early Cambrian (543 Ma) to Late Cambrian (Thomas et al., 2004). Shelf-carbonate successions on the passive margin include quartzose sandstone interbeds (Rankin et al., 1989), which could signify basal sandstone reworkings or sedimentary transport of detritus from the center of the craton to the shelf (Fig. 11) (Thomas et al., 2004). There is evidence of drainage systems from the orogen, as well as a possible Amazon-scale river with headwaters in the Laurentian/Canadian shield and/or northern Appalachians during the Pennsylvanian (Archer

and Greb, 1995; Thomas et al., 2004). Sedimentary rock formed via a similar process is likely the source of the zircons in this study. These sedimentary sequences could have been upturned and deformed during the Taconic Orogeny, leading to erosion and redeposition within the foreland basin.

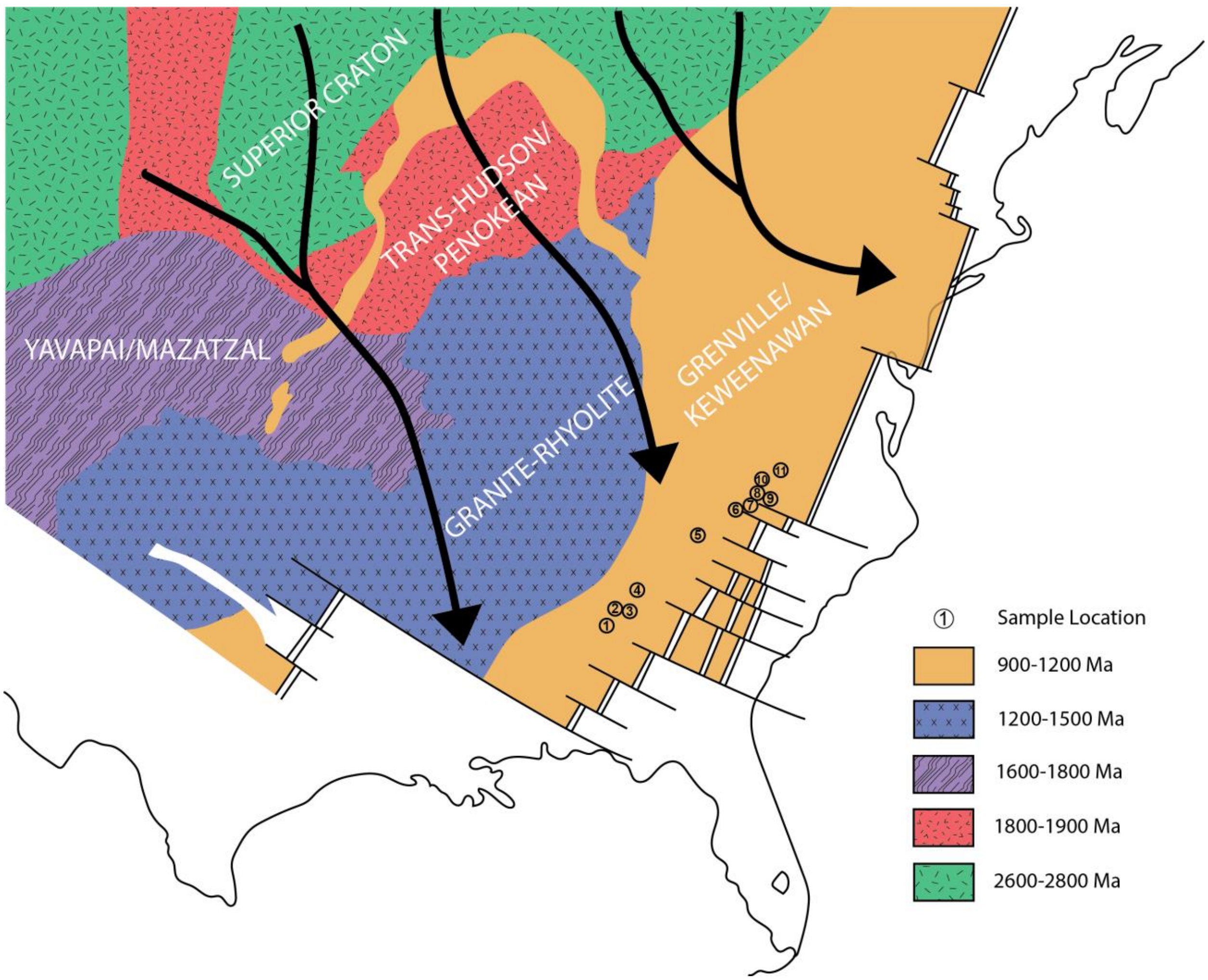

Figure 11. Map of Laurentia showing different provinces and dispersal of sediment during the Cambrian [modified from Thomas et al. (2004)].

A-type Subduction Model

Absence of Paleozoic zircons within the Taconian clastic wedge has been recognized in previous Appalachian literature (e.g. Thomas, 2004; Whisner, 2005). The detrital zircons from

this study suggest a source of recycled zircons exposed by an accretionary wedge during the Taconic Orogeny. This conclusion agrees with previous work that has postulated the lack of Paleozoic-aged material is due to an accretionary wedge (Fig. 5) that formed during the orogeny (Mussman and Read, 1986; Eriksson et al., 2004). Present-day foreland basins are normally separated from volcanic arcs by a fore-arc basin and fore-arc ridge, which could be composed of an accretionary wedge (Hamilton, 1973, 1979; Curray, 1989). Until this accretionary wedge is breached, no arc-derived sediments will be deposited within the foreland basin (Haynes et al., 1998). Sand-sized sediments found within the foreland basin are normally associated with the accretionary prism, as slices of basement rock, or from erosion of previously deposited passive margin sediments (Haynes, 1994).

In the current study, the accretionary wedge is hypothesized to have served as a physical barrier, and thus few Taconic-aged sediments were deposited within the basin. Furthermore, it is hypothesized that sediment previously on the Laurentian margin was upturned and deformed during the formation of the clastic wedge, supporting previous studies (Mack, 1985; Haynes, 1994) which indicated that sediment in the southern Appalachians involved uplift by accretionary wedge, while this wedge also helped shield the foreland basin from arc detritus.

It is important to note that the Colvin Mountain Sandstone samples from Horseleg Mountain and Dirtseller Mountain in northwest Georgia and northeast Alabama, respectively, show an inconsistent amount of younger Taconic-aged zircons when compared to the rest of the sandstones analyzed. These two samples accounted for more than 95% of the Taconic ages found in this study (not including the unnamed pebbly sandstone of Reed Road, Georgia); only four other Taconic ages were found in the other 18 sandstones combined (not including Reed Road). At first glance, these two particular samples seem to have been deposited in an area largely

unaffected by the accretionary wedge mentioned above. This study suggests these samples show more Taconic-aged zircons due to the sandstones' deposition after at least one of the K-bentonites had been erupted and the tephra laid down (see Fig. 2). As the sandstones were deposited, some of the zircons from the K-bentonites were incorporated, which resulted in the majority of Taconic ages being found in these two samples.

As previously mentioned, the Deicke and Millbrig eruptions have been estimated to have been larger than the Tambora and Toba eruptions (Huff et al., 1992; Haynes, 1994). Because of this, the model needs to account for a felsic magma source to explain the explosive nature of the K-bentonites, as these types of explosive eruptions typically occur when sourced by rhyolitic magmas (felsic, higher silica content), as opposed to basaltic magmas (Huff et al., 2010). The east dipping subduction zone proposed for this type of model (e.g. Mussman and Read, 1986; Samson et al., 1989; Carey et al., 2009) accounts for the felsic source, and a study of the parental magmas related to the depleted mantle wedge of the Luzon suduction zone can be used as a modern-day analog, as it has revealed Cathaysian (southeast South China continent) (Xu et al., 2014) zircons in the magma chamber or/and during ascent (Shao et al., 2015). During the orogeny, sediment could also be deposited in the trench, leading to a change in the magma composition, making it become more silica-rich and prone to more explosive eruptions. However, Nd and Sr data collected by Samson et al. (1989) from Ordovician K-bentonites (including the Deicke and Millbrig) show that the bentonites are not primitive, mantle-derived material. For these K-bentonites to be island-arc volcanics, the amount of continental sediment deposited in the trench would need to be more than has occurred in the most contaminated modern-day island arc volcanics (Samson et al., 1989).

The exact volcanic origin of the Deicke and Millbrig K-bentonites is unknown. Carey et al. (2009) chemically analyzed apatites from both ash layers and, by focusing on the differences in concentrations of Mn, Mg, and Cl, demonstrated how homogeneous and heterogeneous the Deicke and Millbrig, respectively, are. While the Deicke has a small range of chemical and isotopic variation, the Millbrig data were mostly separated into three group (Carey et al., 2009). Two ways these differences can be explained are the Millbrig originating from a single eruption from a zoned and/or complex magma chamber, or multiple eruptions from a single volcanic center (Carey et al., 2009).

Samples of the Millbrig K-bentonite bed collected from Hagan, Virginia, show a decrease in silicic content upwards within the K-bentonite layer (Carey et al., 2009). This characteristic has been interpreted as a zoned magma chamber with a higher silica content in the upper half and decreasing silica content with depth (Carey et al., 2009). However, Haynes (1994) observed three separate, feldspathic biotite-rich zones in a Millbrig bed located in Shelbyville, Tennessee, which can be interpreted as separate ash falls. According to Carey et al. (2009), the observations by Haynes (1994) are consistent with the vertically changing chemical composition of apatites at Hagan, Virginia, reinforcing the suggestion that perhaps the Millbrig originates from multiple eruptions from a single volcanic center.

Wedowee-Emuckfaw-Dahlonega Basin

Work done around the Wedowee-Emuckfaw-Dahlonega (WED) basin forms the basis of the proposed idea that an Ordovician back-arc basin developed during the later Ordovician, with the Blount basin hypothesized to have formed on account of the inversion of Neoproterozoic rift-related faults in a retroarc basin landward (towards the Laurentian continent) of the WED Basin (Bayona, 2003; Bayona and Thomas, 2006; Tull et al., 2014; Barineau et al., 2015). The southern

Appalachian Taconic orogeny seems to have been different from the northern Appalachian Taconic orogeny, with a key piece being the lack of an accretionary prism in the southern Appalachians area, different from what is seen in collisional, A-type orogens (Barineau et al., 2015). Tull et al. (2014) and Barineau et al. (2015) suggest a change from an east-dipping subduction zone to a west-dipping subduction zone in this area. The change of subduction direction would account for the seemingly absent accretionary wedge. This change in subduction direction also proposes a transform boundary between the two, different subduction zones in the northern and southern parts of the Taconic Orogeny (Tull et al., 2014; Barineau et al., 2015). In this model, the K-bentonites are sourced from the extended Laurentian continental crust (see Fig. 7), which solves the issue of needing a silicic source in order to create eruptions as immense as the Deicke and Millbrig, which Huff and Kolata (1990) estimated to have ash deposited over an area of at least 600,000 km^2.

The previous model is disproved by several lines of evidence. A study by Hughes and Mahood (2008) found that silica content correlates positively with crustal thickness, and rhyolitic calderas appeared only on crust >25 km thick. Due to Tull et al. (2014) and Barineau et al. (2015)'s model describing the K-bentonites as sourced from extended continental crust, the thickness of this crust becomes an important factor. Furthermore, the notion of the Blount Basin being a retroarc basin and its supposed location in between the WED basin and the Laurentian craton brings forward some inconsistencies with previous research. Various studies (e.g. Hergenroder, 1966; Chowns and Carter, 1983; Jenkins, 1984; Haynes and Goggin, 1993; Bayona, 2003) have determined the depositional environment of the quartz arenites from this study as including shallow, tide-dominated marine and beach/nearshore with longshore currents. Additionally, marine fossils are present in the Walker Sandstone, which also includes low-grade

metamorphic and igneous rocks thought to be from the eroding tectonic highlands (Haynes and Goggin, 1993). These issues make it difficult to agree with the proposed retro-arc model for the Blount Basin.

Ryukyu Tectonic Model

The Ryukyu Arc area provides a useful modern analog for the possible tectonic processes that took place during the Late Ordovician. Here, the Luzon arc is located above an eastern-dipping South China slab and is colliding with the Chinese passive continental margin (Teng, 1990; Sibuet et al., 2002). East of Taiwan, in the post-collisional section of this region, subduction polarity reversal has resulted in the Philippine Sea Plate subducting northward under the Ryukyu Arc, located on the active Eurasian margin (Clift et al., 2003).

Arc-passive margin collision settings, aside from being areas where new continental crust is being added, are also places where active continental margins originate (Clift et al., 2003). Casey and Dewey (1984) argue that because of the mechanical difficulties of breaking cold, stiff oceanic lithosphere, converting a rifted passive margin to an active margin would be difficult unless commenced by arc-continent collision. A simple process for initiating an active margin is the collision of an oceanic arc with a passive margin, followed by a subduction polarity reversal (Clift et al., 2003). This change from passive to active margin can easily be compared to the Laurentian margin during the Ordovician (Fig. 12). In fact, this same process has been studied in the northern Appalachian Mountains, during the collision of an oceanic arc and the passive margin of Laurentia during the early Ordovician (~480-470 Ma) (Draut and Clift, 2001).

The Ryukyu arc-trench system spans an area of 1200 kilometers between Taiwan and Japan, and is caused by the subduction of the Philippine Sea Plate underneath the east Asian

continental margin in a northwestward motion (Shinjo et al., 1999). Active volcanoes in the northern section of the Ryukyu Arc predominantly contain lavas with andesitic compositions, but also range between basalts and rhyolites (e.g. Nakada, 1986; Daishi, 1992). Seismic reflection data from Hirata et al. (1991); Sibuet et al. (1995), have concluded the entire Okinawa Trough is underlain by continental crust. The Okinawa Trough is a back-arc basin in the rifting stage before seafloor spreading (Shinjo et al., 1999). The northern Taiwan Volcanic Zone (NTVZ) is currently in the process of post-collisional, extensional collapse (Teng, 1996). The NTVZ has long been considered part of the Ryukyu Arc (e.g. Chen, 1990; Chung et al., 1995); however some studies (e.g. Chen and Teng, 1997; Wang et al., 1999) have argued the young volcanic area was caused by post-collisional extension of the northern Taiwan Mountain Belt. This differs from central and southern Taiwan, which is an active collision zone between the Luzon Arc and the Asian continent (Teng, 1990). Eruption of high-Mg andesites has been reported in the Central Ryukyus (Shinjo et al., 1991), and these are hypothesized to be caused by slab melting due to athenospheric upwelling (Shinjo, 1999).

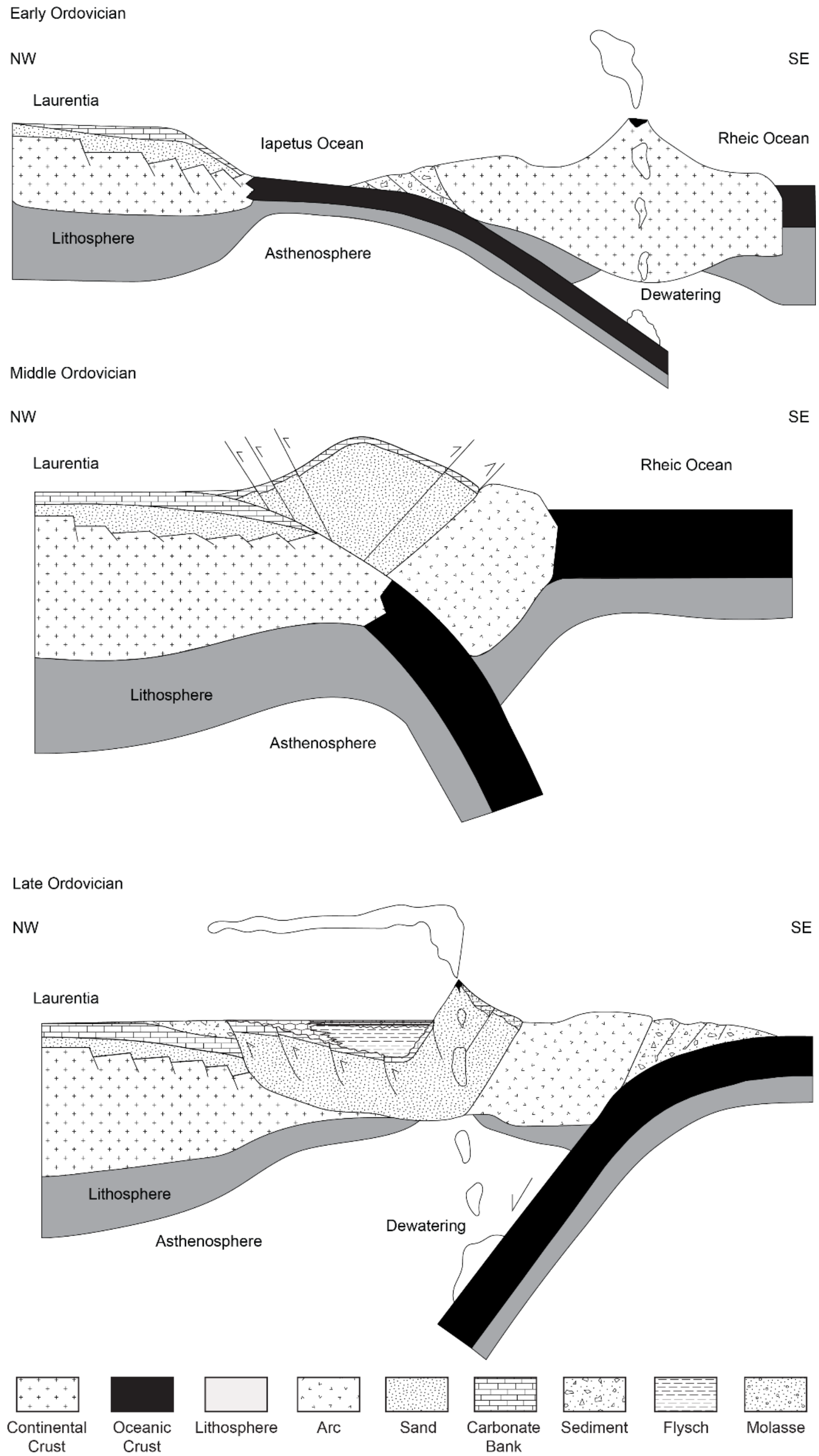

Figure 12. The Late Ordovician can be compared to the present-day Ryukyu Arc tectonic setting.

Volcanism

During the arc/Laurentian margin collision there was a transition from LREE-depleted and mafic compositions to LREE-enriched and siliceous magmas (Draut and Clift, 2001). A similar process is argued to be the source for the explosive eruptions that lead to the Deicke and Millbrig K-bentonites. The same LREE-enriched chemistry is seen both in northern Taiwan and the southern Okinawa Trough magmatism during orogenic collapse (Chen et al., 1995). In that area, the subduction polarity reversal has resulted in the Philippine Sea Plate subducting northward under the Ryukyu Arc, located on the active Eurasian margin (Clift et al., 2003), and this leads to volcanics being erupted through continental margin sediments via the dehydration and melting of a subducted oceanic slab (Wan et al., 2012). Two zircons from Dirtseller Mountain and Horseleg Mountain might be evidence of this same process during the Taconic Orogeny. After analyzing them with CL and afterwards through EMP, these zircons showed significant age differences in their internal structures. The rims of both zircons were Taconic in age (450 ± 15 Ma & 466 ± 16 Ma), while the cores had ages of the Grenville/Keweenawan and Yavapai-Mazatzal provinces (1061 ± 39 Ma & 1663 ± 30 Ma) (Fig. 13B and 13E).

Formation of Quartz Arenites

First-cycle quartz arenites need a special combination of factors to be produced, as they cannot be produced under normal weathering, transportation, and deposition conditions (Suttner et al., 1981). In fact, Suttner et al. (1981) determined most quartz arenites on Earth must be of a multi-cycle origin because of the doubt that such conditions occurred regularly in the past. Rocks need to experience chemical weathering at their source, during transportation, and perhaps during deposition in order for leaching and decomposition to occur (Potter, 1978). Thus, humid climate is a must for the formation of first-cycle quartz arenites (Avigad et al., 2005).

Various studies (e.g. Kump et al., 1999; Young et al., 2005) have linked the transition into end-Ordovician glaciation to increased chemical weathering. This bodes well for the processes needed to weather out the immature sediment coming off the nearby volcanic arc. A study by Swanson-Hysell and Macdonald (2017) hypothesized that the Appalachian margin of Laurentia was within warm, wet, tropical latitudes (equatorward of 10°S at 465 Ma), further strengthening the hypothesis that sediments from the arc could be weathered rapidly into the mature quartz arenites studied in this project. In addition, Cambro-Ordovician aged, mature quartz-sandstones of northern Gondwana (Avigad et al., 2005) have been determined to be first-cycle sediments through U-Pb detrital zircon geochronology (Avigad et al., 2003; Kolodner et al., 2006), and a current-day analog of production of first-cycle quartz arenites is seen in the Orinoco River drainage basin: an area with humid and tropical climate at 8° north (Johnsson et al., 1991). It is thus feasible that the quartz arenites from this project were produced in a similar manner through intense weathering due to hot, humid conditions in the Late Ordovician and transportation along an extended flood/coastal plain.

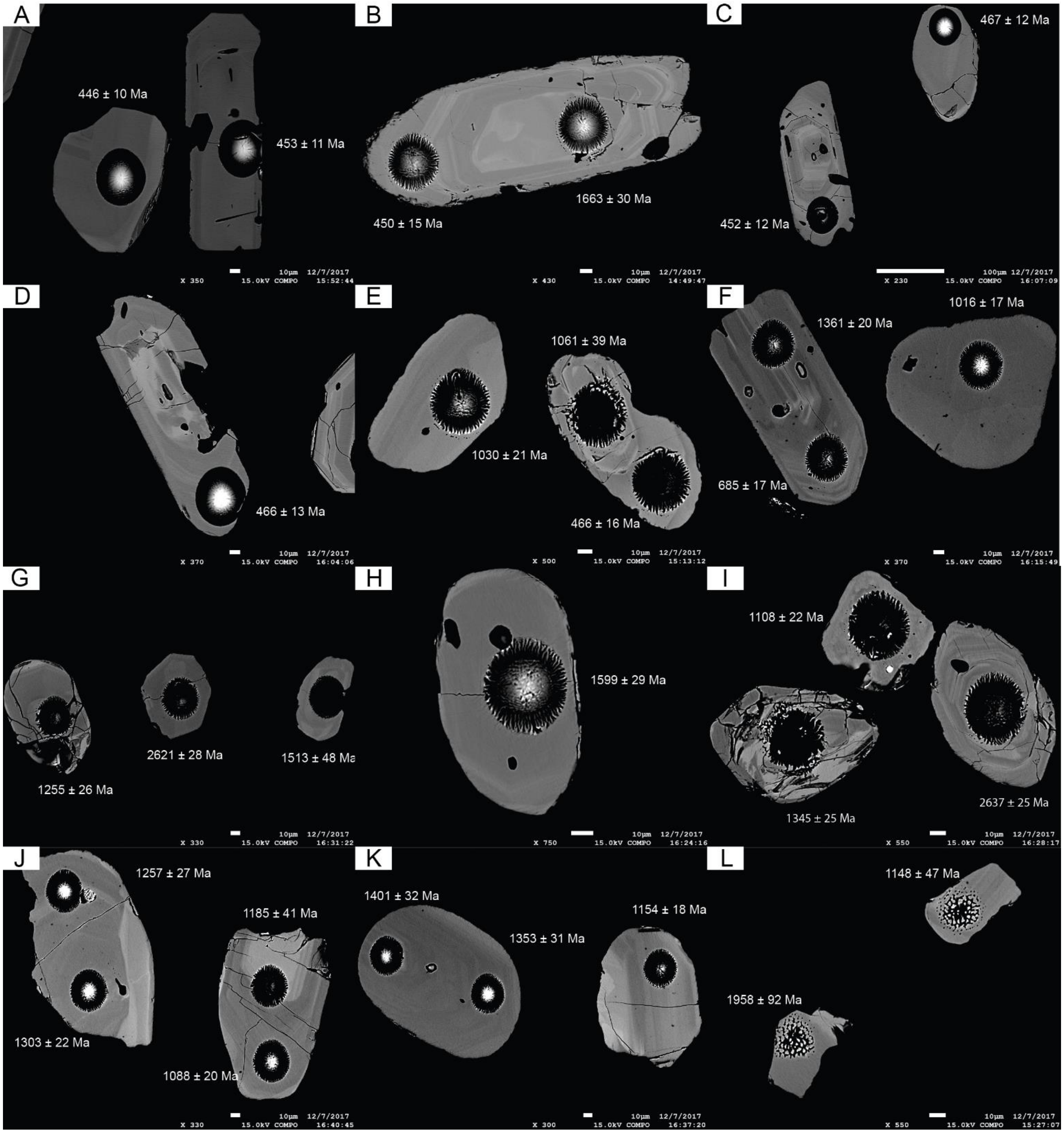

Figure 13. BSE images from select zircon grains. Ordered by ages. (A) Dirtseller Mountain (B) Horseleg Mountain (Coarse). (C) EMP image showing zircons from Dirtseller Mountain. (D) Dirtseller Mountain. (E) Horseleg Mountain (Coarse). (F) Dodson Mountain Bed 7. (G) Mountain Bed 59. (H) Dodson Mountain Bed 59. (I) Dodson Bed 59. (J) Ellett. (K) Ellett. (L) McGraw Gap.

CONCLUSIONS

The quartz arenites in this study contain multicycle sediments, which had been previously deposited as passive-margin deposits during the Cambrian via drainage systems sourced from the Laurentian craton. The zircons were then eroded and redeposited to the S, SE, ESE within the Taconic foreland basin during the waning stages of the Blountian tectophase of the Taconic orogeny. The U-Pb ages acquired from these sandstones supported this notion of Laurentian craton-sourced zircons, with ~96.5% of all ages being older than Taconic. These ages, along with the size and nature of the Deicke and Millbrig K-bentonites found near the sandstones, were the principal components that drove the conclusions on this study.

The sample from Reed Road, Georgia is not Ordovician in age, as its oldest zircon is only 392 ± 19 Ma. Zircon ages from this sandstone could be attributed to the Acadian Orogeny (~350-420 Ma) as plutons of this age have been found within the Appalachian Piedmont. Previous correlations of the Reed Road unnamed pebbly sandstone should be reanalyzed and the area remapped for a more accurate representation of the geology found here.

Certain BSE images from zircons in this study clearly show zircons with old cores and Taconic-aged rims. This was caused by volcanics erupting through continental margin sediments, which lead to these Taconic ages being abundantly found within certain quartz arenites. This is a key finding, as previous Appalachian studies have reported no Paleozoic zircons within the Taconian clastic wedge. Having a continental source is also crucial for the origin of the massive Deicke and Millbrig K-bentonites, as these types of explosive eruptions typically occur when sourced by felsic, high silica content magmas.

A current, modern-day analog to the processes shown in this study is seen via the subduction of the Philippine Sea Plate underneath the east Asian continental margin. Subduction reversal has resulted in the Philippine Sea Plate subducting northward under the Ryukyu Arc. LREE-enriched magmatism found at this locale, driven by renewed subduction, gives a mechanism for the generation of high silica magmas that are prone to explosive eruptions. This process also leads to volcanics being erupted through continental margin sediments via the dehydration and melting of a subducted slab, which can be effectively applied to the southern Appalachians during the Late Ordovician and is consistent with the detrital zircons found with Taconic-aged rims, but older Proterozoic cores.

The production of quartz-rich sandstones is evidence for a humid, tropical climate along the Appalachian margin of Laurentia at this time in the Ordovician. Through this intense chemical weathering, the sandstones are hypothesized to have been produced through transportation along an extended flood/coastal plain environment, not unlike the production of quartz arenites seen today in the Orinoco River drainage basin.

APPENDIX. U-Pb AGES

Table A1. U-Pb Ages: Alexander Gap, AL Section

Sample ID	$^{207}Pb/^{235}U$ (Ma)	±2σ (Ma)	$^{206}Pb/^{238}U$ (Ma)	±2σ (Ma)	Discordance (%)
Plug 4					
AlexGap_1	1033	17	1023	21	1
AlexGap_2	1113	17	1111	22	0
AlexGap_3	994	18	987	20	1
AlexGap_4	963	17	988	22	3
AlexGap_5	1310	22	1287	29	2
AlexGap_6	987	17	985	21	0
AlexGap_7	1239	20	1253	26	1
AlexGap_8	1006	18	1039	22	3
AlexGap_9	1372	17	1377	23	0
AlexGap_10	1294	20	1292	28	0
AlexGap_11	1049	12	1066	15	2
AlexGap_12	1409	20	1417	27	1
AlexGap_13	1149	18	1175	27	2
AlexGap_14	1438	20	1447	30	1
AlexGap_15	1141	20	1052	22	8
AlexGap_16	1042	17	1039	22	0
AlexGap_17	999	16	988	21	1
AlexGap_18	1282	20	1259	25	2
AlexGap_19	1123	17	1108	22	1
AlexGap_20	1097	16	1115	22	2
AlexGap_21	997	17	1017	19	2
AlexGap_22	1075	19	1040	22	3
AlexGap_23	1139	17	1140	23	0
AlexGap_24	1305	26	1202	26	8
AlexGap_25	984	16	977	21	1
AlexGap_26	1447	18	1444	28	0
AlexGap_27	1260	19	1230	27	2
AlexGap_28	1452	18	1459	29	0
AlexGap_29	1531	21	1493	32	2
AlexGap_30	1005	15	1000	19	0
AlexGap_31	1156	15	1158	21	0
AlexGap_32	1124	27	1127	35	0
AlexGap_33	1130	14	1137	20	1
AlexGap_34	1090	16	1088	23	0
AlexGap_35	1233	16	1231	22	0
AlexGap_36	510	11	520	10	2
AlexGap_37	1745	21	1757	30	1

AlexGap_38	1169	18	1154	23	1
AlexGap_39	995	15	978	20	2
AlexGap_40	965	13	962	18	0
AlexGap_41	1158	16	1114	23	4
AlexGap_42	1343	18	1350	28	1
AlexGap_43	1070	13	1067	19	0
AlexGap_44	1039	14	1036	18	0
AlexGap_45	1039	19	1029	22	1
AlexGap_46	1010	15	1011	22	0
AlexGap_47	965	21	960	22	1
AlexGap_48	958	14	959	18	0
AlexGap_49	1002	17	1004	19	0
AlexGap_50	1452	17	1428	28	2
AlexGap_51	1014	15	1001	19	1
AlexGap_52	1393	17	1392	24	0
AlexGap_53	1035	13	1034	18	0
AlexGap_54	1350	19	1336	29	1
AlexGap_55	1167	16	1149	24	2
AlexGap_56	1403	15	1425	26	2
AlexGap_57	1225	18	1227	24	0
AlexGap_58	1014	13	1015	19	0
AlexGap_59	1084	22	1090	24	1
AlexGap_60	993	14	961	18	3
AlexGap_61	1001	13	1001	17	0
AlexGap_62	1413	15	1412	27	0
AlexGap_63	1008	14	1002	18	1
AlexGap_64	1284	14	1261	22	2
AlexGap_65	1228	29	1052	19	14
AlexGap_66	550	10	538	10	2
AlexGap_67	984	11	986	16	0
AlexGap_68	1345	16	1332	27	1
AlexGap_69	1458	12	1484	23	2
AlexGap_70	1003	13	1020	19	2
AlexGap_71	1177	15	1179	21	0
AlexGap_72	1005	15	1010	18	0
AlexGap_73	1002	15	999	18	0
AlexGap_74	1089	12	1085	18	0
AlexGap_75	1425	12	1437	22	1
AlexGap_76	1334	15	1294	23	3
AlexGap_77	1000	12	1007	18	1
AlexGap_78	1020	18	1018	19	0
AlexGap_79	1167	11	1187	20	2
AlexGap_80	1036	12	1035	16	0
AlexGap_81	1044	13	1056	16	1

AlexGap_82	1470	19	1504	32	2
AlexGap_83	1439	19	1446	31	0
AlexGap_84	530	11	377	10	29
AlexGap_85	2673	20	2687	45	1
AlexGap_86	1150	18	1174	25	2
AlexGap_87	1211	28	1202	32	1
AlexGap_88	1011	18	1034	24	2
AlexGap_89	1456	19	1457	31	0
AlexGap_90	1465	20	1464	33	0
AlexGap_91	1043	18	973	26	7
AlexGap_92	1324	21	1336	31	1
AlexGap_93	1154	20	1180	28	2
AlexGap_94	1291	19	1286	33	0
AlexGap_95	1060	16	1059	26	0
AlexGap_96	1039	24	1021	30	2
AlexGap_97	999	16	1017	22	2
AlexGap_98	1423	19	1452	34	2
AlexGap_99	1009	15	1004	19	0
AlexGap_100	1015	15	1016	19	0
Plug 8					
AlexanderGap_1	1218	31	1179	48	3
AlexanderGap_2	1077	21	1111	42	3
AlexanderGap_3	1132	18	1155	37	2
AlexanderGap_4	1077	16	1105	29	3
AlexanderGap_5	1152	22	1183	37	3
AlexanderGap_6	1240	22	1273	40	3
AlexanderGap_7	1492	34	1482	53	1
AlexanderGap_8	1439	24	1486	41	3
AlexanderGap_9	1134	28	1143	34	1
AlexanderGap_10	770	25	655	32	15
AlexanderGap_11	1165	25	1191	36	2
AlexanderGap_12	1186	23	1163	33	2
AlexanderGap_13	1189	19	1169	31	2
AlexanderGap_14	1179	18	1189	33	1
AlexanderGap_15	1182	21	1206	33	2
AlexanderGap_16	1027	16	1056	27	3
AlexanderGap_17	1806	78	1382	51	23
AlexanderGap_18	1050	24	1051	33	0
AlexanderGap_19	1599	32	1612	63	1
AlexanderGap_20	1203	22	1257	37	4
AlexanderGap_21	1323	37	1226	69	7
AlexanderGap_22	2428	39	2184	84	10
AlexanderGap_23	1146	38	1162	51	1
AlexanderGap_24	1040	22	1083	34	4

AlexanderGap_25	1280	26	1276	39	0
AlexanderGap_26	1060	20	1087	34	3
AlexanderGap_27	1039	16	1061	28	2
AlexanderGap_28	1060	17	1075	30	1
AlexanderGap_29	1056	19	1085	31	3
AlexanderGap_30	1485	21	1535	45	3
AlexanderGap_31	1041	23	1077	36	3
AlexanderGap_32	1360	21	1381	37	2
AlexanderGap_33	1196	20	1216	36	2
AlexanderGap_34	472	20	472	15	0
AlexanderGap_35	1033	25	1055	39	2
AlexanderGap_36	1473	24	1481	48	1
AlexanderGap_37	1112	24	1118	41	1
AlexanderGap_38	1248	23	1283	37	3
AlexanderGap_39	1339	23	1372	41	2
AlexanderGap_40	1109	22	1133	39	2
AlexanderGap_41	1194	35	1232	53	3
AlexanderGap_42	1048	28	1070	55	2
AlexanderGap_43	1046	29	1059	44	1
AlexanderGap_44	1323	29	1353	49	2
AlexanderGap_45	1253	34	1229	53	2
AlexanderGap_46	1232	22	1255	34	2
AlexanderGap_47	1072	25	1075	37	0
AlexanderGap_48	1323	28	1357	50	3
AlexanderGap_49	1303	31	1341	39	3
AlexanderGap_50	1376	19	1395	33	1
AlexanderGap_51	1073	22	1102	38	3
AlexanderGap_52	1054	24	1080	35	2
AlexanderGap_53	1042	18	1070	28	3
AlexanderGap_54	1036	21	1059	36	2
AlexanderGap_55	1046	22	1054	29	1
AlexanderGap_56	1042	24	1067	34	2
AlexanderGap_57	1239	31	1256	43	1
AlexanderGap_58	1044	25	1069	37	2
AlexanderGap_59	1168	32	1088	48	7
AlexanderGap_60	1437	31	1445	51	1
AlexanderGap_61	1041	26	1071	44	3
AlexanderGap_62	1067	25	1085	38	2
AlexanderGap_63	1074	23	1071	38	0
AlexanderGap_64	1265	25	1239	40	2
AlexanderGap_65	1236	32	1263	54	2
AlexanderGap_66	1243	36	1249	47	0
AlexanderGap_67	1093	17	1135	28	4
AlexanderGap_68	1072	22	1071	35	0

AlexanderGap_69	996	22	1010	33	1
AlexanderGap_70	1054	21	1100	32	4
AlexanderGap_71	1458	26	1485	49	2
AlexanderGap_72	1273	25	1296	46	2
AlexanderGap_73	1082	21	1104	32	2
AlexanderGap_74	1167	26	1192	37	2
AlexanderGap_75	1053	17	1071	29	2
AlexanderGap_76	1612	34	1619	61	0
AlexanderGap_77	1179	28	1191	36	1
AlexanderGap_78	1398	30	1450	48	4
AlexanderGap_79	1117	21	1129	31	1
AlexanderGap_80	1032	20	1064	32	3
AlexanderGap_81	1028	28	1045	35	2
AlexanderGap_82	1160	25	1184	44	2
AlexanderGap_83	1326	21	1351	43	2
AlexanderGap_84	1293	25	1323	40	2
AlexanderGap_85	921	26	834	39	9
AlexanderGap_86	1457	23	1486	42	2
AlexanderGap_87	1021	23	1043	35	2
AlexanderGap_88	1064	24	1077	34	1
AlexanderGap_89	1412	26	1371	49	3
AlexanderGap_90	1072	31	1068	39	0
AlexanderGap_91	976	33	964	45	1
AlexanderGap_92	1209	28	1199	50	1
AlexanderGap_93	1063	20	1066	29	0
AlexanderGap_94	1165	25	1167	36	0
AlexanderGap_95	1008	21	1029	37	2
AlexanderGap_96	1034	32	1029	53	0
AlexanderGap_97	1089	32	1060	47	3
AlexanderGap_98	1009	27	1017	45	1
AlexanderGap_99	1034	36	1053	55	2
AlexanderGap_100	1085	33	1065	45	2

Table A2. U-Pb Ages: Horseleg Mountain, GA Section

Sample ID	**^{207}Pb/^{235}U (Ma)**	**±2σ (Ma)**	**^{206}Pb/^{238}U (Ma)**	**±2σ (Ma)**	**Discordance (%)**
Plug 2-Coarse					
HorselegCoarse_1	1006	9	922	12	8
HorselegCoarse_2	1060	15	950	18	10
HorselegCoarse_3	1060	10	1048	13	1
HorselegCoarse_4	1098	9	1086	12	1
HorselegCoarse_5	1082	10	979	15	9
HorselegCoarse_6	1023	9	911	12	11
HorselegCoarse_7	1438	10	1418	16	1
HorselegCoarse_8	1447	10	1432	17	1
HorselegCoarse_9	1426	12	1405	18	1
HorselegCoarse_10	1038	12	992	14	4
Plug 8-Coarse					
HorselegCoarse_1	1471	33	1488	72	1
HorselegCoarse_2	1185	30	1180	49	0
HorselegCoarse_3	1180	24	1185	43	0
HorselegCoarse_4	1019	25	1042	44	2
HorselegCoarse_5	1030	25	1007	39	2
HorselegCoarse_6	1661	31	1652	56	1
HorselegCoarse_7	1094	26	1100	44	1
HorselegCoarse_8	1502	30	1534	54	2
HorselegCoarse_9	1370	32	1359	54	1
HorselegCoarse_10	1036	24	1064	43	3
HorselegCoarse_11	1153	29	1171	47	2
HorselegCoarse_12	1150	41	1084	50	6
HorselegCoarse_13	1232	24	1245	44	1
HorselegCoarse_14	882	31	714	36	19
HorselegCoarse_15	1307	25	1283	41	2
HorselegCoarse_16	1416	29	1385	56	2
HorselegCoarse_17	1100	30	1031	48	6
HorselegCoarse_18	1077	27	1095	45	2
HorselegCoarse_19	1162	27	1086	45	7
HorselegCoarse_20	1210	25	1190	42	2
HorselegCoarse_21	1056	26	1078	41	2
HorselegCoarse_22	1049	26	1073	40	2
HorselegCoarse_23	598	21	467	19	22
HorselegCoarse_24	1451	28	1470	54	1
HorselegCoarse_25	1452	37	1478	74	2
HorselegCoarse_26	2842	43	2880	110	1
HorselegCoarse_27	1391	27	1357	46	2
HorselegCoarse_28	1047	31	1070	46	2
HorselegCoarse_29	488	21	474	21	3

HorselegCoarse_30	533	21	533	25	0
HorselegCoarse_31	1350	29	1355	61	0
HorselegCoarse_32	465	15	450	17	3
HorselegCoarse_33	1370	32	1393	55	2
HorselegCoarse_34	1177	28	1182	52	0
HorselegCoarse_35	1174	29	1224	51	4
HorselegCoarse_36	1147	29	1153	53	1
HorselegCoarse_37	1300	33	1280	61	2
HorselegCoarse_38	1476	26	1510	52	2
HorselegCoarse_39	1045	24	1098	46	5
HorselegCoarse_40	1110	37	1135	56	2
HorselegCoarse_41	1044	30	1029	43	1
HorselegCoarse_42	1023	25	1040	39	2
HorselegCoarse_43	999	29	1023	51	2
HorselegCoarse_44	1094	23	1124	37	3
HorselegCoarse_45	1387	32	1315	58	5
HorselegCoarse_46	1376	27	1391	54	1
HorselegCoarse_47	1189	24	1213	50	2
HorselegCoarse_48	1451	30	1447	60	0
HorselegCoarse_49	720	23	519	29	28
HorselegCoarse_50	1063	23	1071	39	1
HorselegCoarse_51	1093	28	1129	50	3
HorselegCoarse_52	1039	24	1057	42	2
HorselegCoarse_53	987	23	973	36	1
HorselegCoarse_54	1472	35	1479	60	0
HorselegCoarse_55	1470	31	1484	60	1
HorselegCoarse_56	1467	30	1506	55	3
HorselegCoarse_57	1035	32	949	53	8
HorselegCoarse_58	1005	22	1000	36	0
HorselegCoarse_59	1508	35	1528	75	1
HorselegCoarse_60	991	27	956	35	4
HorselegCoarse_61	1476	34	1396	63	5
HorselegCoarse_62	1079	33	1053	46	2
HorselegCoarse_63	998	27	910	35	9
HorselegCoarse_64	1075	25	1107	42	3
HorselegCoarse_65	1044	27	1059	46	1
HorselegCoarse_66	1037	26	1035	44	0
HorselegCoarse_67	1227	34	1230	47	0
HorselegCoarse_68	1110	29	1128	52	2
HorselegCoarse_69	1034	28	1046	38	1
HorselegCoarse_70	990	26	925	40	7
HorselegCoarse_71	1421	30	1397	50	2
HorselegCoarse_72	1199	27	1197	55	0
HorselegCoarse_73	1029	26	1046	42	2

HorselegCoarse_74	1082	26	1111	46	3
HorselegCoarse_75	455	14	471	22	4
HorselegCoarse_76	1465	33	1466	68	0
HorselegCoarse_77	1050	24	1062	40	1
HorselegCoarse_78	836	25	705	34	16
HorselegCoarse_79	851	27	741	34	13
HorselegCoarse_80	962	33	838	46	13
HorselegCoarse_81	908	24	727	30	20
HorselegCoarse_82	968	29	972	44	0
HorselegCoarse_83	1047	26	1047	42	0
HorselegCoarse_84	1054	24	1069	45	1
HorselegCoarse_85	1217	32	1188	57	2
HorselegCoarse_86	1801	32	1869	68	4
HorselegCoarse_87	1045	27	1063	43	2
HorselegCoarse_88	909	29	771	38	15
HorselegCoarse_89	923	23	798	34	14
HorselegCoarse_90	1352	30	1294	51	4
HorselegCoarse_91	1216	34	1200	48	1
HorselegCoarse_92	1026	25	1054	43	3
HorselegCoarse_93	1139	26	1151	36	1
HorselegCoarse_94	464	17	458	22	1
HorselegCoarse_95	1028	25	1029	42	0
HorselegCoarse_96	1277	27	1309	52	3
HorselegCoarse_97	1024	28	1045	47	2
HorselegCoarse_98	1142	20	1135	37	1
HorselegCoarse_99	1022	20	1024	34	0
HorselegCoarse_100	1161	25	1179	46	2
HorselegCoarse_101	1247	40	1176	49	6
HorselegCoarse_102	465	15	468	18	1
HorselegCoarse_103	1488	29	1517	61	2
HorselegCoarse_104	1298	32	1325	55	2
HorselegCoarse_105	1058	25	1075	42	2
HorselegCoarse_106	1869	34	1896	76	1
HorselegCoarse_107	1145	38	1060	53	7
HorselegCoarse_108	1026	22	1039	37	1
HorselegCoarse_109	1286	31	1281	50	0
HorselegCoarse_110	2747	35	2790	100	2
HorselegCoarse_111	981	27	968	48	1
HorselegCoarse_112	1042	30	981	47	6
HorselegCoarse_113	1338	32	1361	70	2
HorselegCoarse_114	1170	26	1185	50	1
HorselegCoarse_115	1143	30	1171	48	2
HorselegCoarse_116	467	17	465	21	0
HorselegCoarse_117	710	53	423	24	40

HorselegCoarse_118	418	16	294	16	30
HorselegCoarse_119	1069	40	1054	56	1
HorselegCoarse_120	1203	29	1233	51	2
HorselegCoarse_121	1352	30	1361	53	1
HorselegCoarse_122	1265	26	1303	44	3
HorselegCoarse_123	483	16	404	18	16
HorselegCoarse_124	1357	30	1367	53	1
HorselegCoarse_125	1478	32	1474	58	0
HorselegCoarse_126	1554	32	1528	51	2
HorselegCoarse_127	1081	28	1088	44	1
HorselegCoarse_128	1212	27	1175	42	3
HorselegCoarse_129	1612	34	1637	72	2
HorselegCoarse_130	1224	54	1080	54	12
HorselegCoarse_131	1156	29	1165	49	1
HorselegCoarse_132	1257	32	1254	59	0
HorselegCoarse_133	1417	33	1423	57	0
HorselegCoarse_134	1337	34	1317	61	1
HorselegCoarse_135	1036	26	1035	45	0
HorselegCoarse_136	1479	30	1507	63	2
HorselegCoarse_137	1487	31	1498	64	1
HorselegCoarse_138	1194	30	1212	50	2
HorselegCoarse_139	1333	31	1337	59	0
HorselegCoarse_140	474	17	464	22	2
HorselegCoarse_141	1346	33	1356	64	1
HorselegCoarse_142	1216	33	1229	51	1
HorselegCoarse_143	1022	28	1021	48	0
HorselegCoarse_144	1436	35	1449	67	1
HorselegCoarse_145	1047	29	1046	45	0
HorselegCoarse_146	1424	31	1451	62	2
HorselegCoarse_147	1087	25	1085	43	0
HorselegCoarse_148	1113	28	1124	42	1
HorselegCoarse_149	1086	32	1066	45	2
HorselegCoarse_150	1542	39	1505	63	2
HorselegCoarse_151	1030	21	1020	39	1
HorselegCoarse_152	1061	39	953	49	10
HorselegCoarse_153	466	16	472	23	1
HorselegCoarse_154	1011	23	1031	36	2
HorselegCoarse_155	1329	31	1308	53	2
HorselegCoarse_156	1457	29	1477	60	1
HorselegCoarse_157	1027	25	1040	48	1
HorselegCoarse_158	1185	29	1192	48	1
HorselegCoarse_159	1186	31	1187	51	0
HorselegCoarse_160	1051	30	1017	48	3
HorselegCoarse_161	1043	26	1032	44	1

HorselegCoarse_162	1183	29	1150	50	3
HorselegCoarse_163	1153	34	1146	56	1
HorselegCoarse_164	1352	37	1297	58	4
HorselegCoarse_165	1054	25	1071	45	2
HorselegCoarse_166	1129	26	1136	53	1
HorselegCoarse_167	958	26	988	40	3
HorselegCoarse_168	1011	26	1010	42	0
HorselegCoarse_169	1162	23	1171	46	1
HorselegCoarse_170	468	17	459	23	2
HorselegCoarse_171	457	15	445	18	3
HorselegCoarse_172	484	16	463	21	4
HorselegCoarse_173	488	19	457	20	6
HorselegCoarse_174	483	16	471	24	2
HorselegCoarse_175	1158	30	1140	48	2
HorselegCoarse_176	466	17	466	18	0
HorselegCoarse_177	1041	25	1062	39	2
HorselegCoarse_178	649	42	604	36	7
HorselegCoarse_179	1073	31	917	50	15
HorselegCoarse_180	760	53	345	32	55
HorselegCoarse_181	1054	26	1064	48	1
HorselegCoarse_182	1054	22	1060	41	1
HorselegCoarse_183	1458	32	1459	58	0
HorselegCoarse_184	1030	23	1035	40	0
HorselegCoarse_185	1310	34	1331	66	2
HorselegCoarse_186	1214	41	1095	62	10
HorselegCoarse_187	625	20	440	24	30
HorselegCoarse_188	1446	29	1457	55	1
HorselegCoarse_189	1314	31	1291	57	2
HorselegCoarse_190	1358	27	1352	56	0
HorselegCoarse_191	1012	27	1036	43	2
HorselegCoarse_192	1150	25	1164	44	1
HorselegCoarse_193	480	16	465	19	3
HorselegCoarse_194	1398	34	1340	55	4
HorselegCoarse_195	929	30	673	38	28
HorselegCoarse_196	1375	37	1357	65	1
HorselegCoarse_197	1460	34	1444	57	1
HorselegCoarse_198	1416	32	1425	61	1
HorselegCoarse_199	1160	28	1157	47	0
HorselegCoarse_200	1018	24	1030	37	1
LA 20150810 Z JMU HorselegMtn					
HorselegMtnJMU_1	1076	26	982	42	9
HorselegMtnJMU_2	607	27	420	26	31
HorselegMtnJMU_3	1119	34	1130	66	1
HorselegMtnJMU_4	1175	33	1140	36	3

HorselegMtnJMU_5	1202	39	1071	48	11
HorselegMtnJMU_6	1107	33	1106	55	0
HorselegMtnJMU_7	513	23	497	30	3
HorselegMtnJMU_8	478	20	490	27	3
HorselegMtnJMU_9	1460	120	1260	150	14
HorselegMtnJMU_10	1218	42	1181	76	3
HorselegMtnJMU_11	1197	54	1132	68	5
HorselegMtnJMU_12	1218	50	1102	83	10
HorselegMtnJMU_13	1173	42	1028	60	12
HorselegMtnJMU_14	1353	55	1325	96	2
HorselegMtnJMU_15	2113	53	2110	130	0
HorselegMtnJMU_16	1074	51	1097	81	2
HorselegMtnJMU_17	1083	46	1009	67	7
HorselegMtnJMU_18	1066	40	1021	68	4
HorselegMtnJMU_19	1212	55	816	62	33
HorselegMtnJMU_20	1113	55	946	72	15
HorselegMtnJMU_21	1133	50	945	68	17
HorselegMtnJMU_22	1032	36	1020	61	1
HorselegMtnJMU_23	1318	46	1155	80	12
HorselegMtnJMU_24	1036	39	852	63	18
HorselegMtnJMU_25	1248	50	1145	78	8
HorselegMtnJMU_26	1369	60	1380	120	1
HorselegMtnJMU_27	1174	56	1180	100	1
HorselegMtnJMU_28	1299	49	990	68	24
HorselegMtnJMU_29	1115	54	1140	100	2
HorselegMtnJMU_30	1109	49	1053	81	5
HorselegMtnJMU_31	914	49	628	60	31
HorselegMtnJMU_32	2588	66	2550	170	1
HorselegMtnJMU_33	1147	59	1058	91	8
HorselegMtnJMU_34	1097	61	1150	100	5
HorselegMtnJMU_35	1210	110	1040	160	14
HorselegMtnJMU_36	1012	57	909	79	10
HorselegMtnJMU_37	1226	62	1210	110	1
HorselegMtnJMU_38	1239	48	1216	92	2
HorselegMtnJMU_39	1197	44	1080	79	10
HorselegMtnJMU_40	1248	56	1033	78	17
HorselegMtnJMU_41	1081	42	926	59	14
HorselegMtnJMU_42	1083	40	1055	72	3
HorselegMtnJMU_43	1380	37	1268	72	8
HorselegMtnJMU_44	1225	39	970	50	21
HorselegMtnJMU_45	1394	50	952	62	32
HorselegMtnJMU_46	1120	47	1118	81	0
HorselegMtnJMU_47	1142	41	1013	66	11
HorselegMtnJMU_48	1049	34	937	58	11

HorselegMtnJMU_49	1442	50	1456	75	1
HorselegMtnJMU_50	1049	45	1081	77	3
HorselegMtnJMU_51	1087	45	1023	79	6
HorselegMtnJMU_52	329	12	334	10	2
HorselegMtnJMU_53	1305	53	1219	96	7
HorselegMtnJMU_54	1063	51	870	72	18
HorselegMtnJMU_55	1129	35	1017	61	10
HorselegMtnJMU_56	1102	44	1086	76	1
HorselegMtnJMU_57	598	37	508	44	15
HorselegMtnJMU_58	1374	59	1400	110	2
HorselegMtnJMU_59	559	36	524	50	6
HorselegMtnJMU_60	1219	40	1080	70	11
HorselegMtnJMU_61	1066	47	1081	87	1
HorselegMtnJMU_62	1117	39	1102	74	1
HorselegMtnJMU_63	1151	62	1112	99	3
HorselegMtnJMU_64	1187	55	1190	100	0
HorselegMtnJMU_65	996	50	823	71	17
HorselegMtnJMU_66	2454	61	2150	140	12
HorselegMtnJMU_67	1073	41	1077	83	0
HorselegMtnJMU_68	1277	61	1169	82	8
HorselegMtnJMU_69	1098	37	1033	68	6
HorselegMtnJMU_70	1048	40	1074	78	2
HorselegMtnJMU_71	1060	51	1021	85	4
HorselegMtnJMU_72	1079	45	1052	72	3
HorselegMtnJMU_73	1029	46	958	74	7
HorselegMtnJMU_74	1189	51	983	73	17
HorselegMtnJMU_75	1008	38	704	51	30
HorselegMtnJMU_76	1003	41	983	66	2
HorselegMtnJMU_77	1049	42	1063	72	1
HorselegMtnJMU_78	1070	49	1036	82	3
HorselegMtnJMU_79	2611	62	2430	160	7
HorselegMtnJMU_80	1265	55	1069	76	15
HorselegMtnJMU_81	1222	48	1049	74	14
HorselegMtnJMU_82	1072	41	972	63	9
HorselegMtnJMU_83	1058	43	798	54	25
HorselegMtnJMU_84	1260	54	1038	70	18
HorselegMtnJMU_85	1251	54	1290	100	3
HorselegMtnJMU_86	1326	44	1361	69	3
HorselegMtnJMU_87	1339	46	1062	62	21
HorselegMtnJMU_88	1340	37	1236	66	8
HorselegMtnJMU_89	1371	44	1281	66	7
HorselegMtnJMU_90	1213	42	1109	62	9
HorselegMtnJMU_91	1077	42	937	61	13
HorselegMtnJMU_92	616	34	412	35	33

HorselegMtnJMU_93	1180	49	1091	78	8
HorselegMtnJMU_94	1050	37	891	50	15
HorselegMtnJMU_95	1695	66	1023	49	40
HorselegMtnJMU_96	1114	32	1048	50	6
HorselegMtnJMU_97	1072	35	1032	62	4
HorselegMtnJMU_98	1318	49	991	51	25
HorselegMtnJMU_99	1536	43	1503	83	2
HorselegMtnJMU_100	1199	30	1093	49	9
HorselegMtnJMU_101	1100	32	1050	53	5
HorselegMtnJMU_102	1505	42	945	35	37
HorselegMtnJMU_103	1503	39	1478	71	2
HorselegMtnJMU_104	1405	54	1129	69	20
HorselegMtnJMU_105	1097	42	1027	68	6
HorselegMtnJMU_106	1053	34	1051	58	0
HorselegMtnJMU_107	1107	47	1082	79	2
HorselegMtnJMU_108	977	45	769	57	21
HorselegMtnJMU_109	1164	44	1058	68	9
HorselegMtnJMU_110	1135	51	935	70	18
HorselegMtnJMU_111	1343	68	1072	68	20
HorselegMtnJMU_112	1037	31	821	47	21
HorselegMtnJMU_113	1020	36	915	50	10
HorselegMtnJMU_114	1285	39	1083	63	16
HorselegMtnJMU_115	1014	43	896	64	12
HorselegMtnJMU_116	1111	36	1117	69	1
HorselegMtnJMU_117	1103	47	1034	73	6
HorselegMtnJMU_118	1232	55	1045	92	15
HorselegMtnJMU_119	1072	39	1031	68	4
HorselegMtnJMU_120	1178	48	1140	81	3
HorselegMtnJMU_121	1512	49	1515	98	0
HorselegMtnJMU_122	1089	40	1042	64	4
HorselegMtnJMU_123	1119	45	1015	65	9
HorselegMtnJMU_124	1405	49	786	54	44
HorselegMtnJMU_125	2481	54	2300	130	7
Plug 9-Fine					
HorselegFine_1	1037	31	831	44	20
HorselegFine_2	1640	29	1667	68	2
HorselegFine_3	1222	32	1293	59	6
HorselegFine_4	1079	22	1067	44	1
HorselegFine_5	1448	26	1413	54	2
HorselegFine_6	513	17	411	20	20
HorselegFine_7	1139	30	1151	49	1
HorselegFine_8	1185	23	1197	42	1
HorselegFine_9	456	13	454	17	0
HorselegFine_10	1202	20	1212	39	1

HorselegFine_11	1123	27	1144	42	2
HorselegFine_12	1407	34	1237	62	12
HorselegFine_13	1384	24	1374	54	1
HorselegFine_14	1926	31	2015	67	5
HorselegFine_15	1422	28	1430	53	1
HorselegFine_16	1483	29	1421	56	4
HorselegFine_17	1044	26	858	40	18
HorselegFine_18	1339	32	1346	63	1
HorselegFine_19	1384	27	1402	57	1
HorselegFine_20	468	14	470	19	0
HorselegFine_21	1321	31	1348	61	2
HorselegFine_22	1572	37	1691	74	8
HorselegFine_23	1011	23	964	37	5
HorselegFine_24	1480	32	1498	60	1
HorselegFine_25	1434	31	1441	58	0
HorselegFine_26	1352	32	1371	60	1
HorselegFine_27	1219	33	1104	55	9
HorselegFine_28	940	26	874	34	7
HorselegFine_29	1441	29	1375	46	5
HorselegFine_30	1443	29	1462	61	1
HorselegFine_31	1367	35	1180	55	14
HorselegFine_32	5453	59	7130	260	31
HorselegFine_33	1555	32	1603	57	3
HorselegFine_34	1130	27	1114	40	1
HorselegFine_35	1696	40	1613	73	5
HorselegFine_36	1015	27	1046	52	3
HorselegFine_37	1726	37	1749	81	1
HorselegFine_38	1009	22	1017	35	1
HorselegFine_39	665	24	410	25	38
HorselegFine_40	957	27	862	41	10
HorselegFine_41	1037	27	720	40	31
HorselegFine_42	1710	35	1690	71	1
HorselegFine_43	882	28	852	41	3
HorselegFine_44	1062	25	919	41	13
HorselegFine_45	517	20	464	20	10
HorselegFine_46	480	13	481	18	0
HorselegFine_47	1396	32	1369	61	2
HorselegFine_48	1040	26	1069	42	3
HorselegFine_49	1137	27	1140	40	0
HorselegFine_50	1199	58	877	67	27
HorselegFine_51	1123	29	1040	41	7
HorselegFine_52	990	24	851	36	14
HorselegFine_53	1492	28	1535	55	3
HorselegFine_54	1295	29	1202	50	7

HorselegFine_55	1390	31	1392	59	0
HorselegFine_56	1452	32	1442	63	1
HorselegFine_57	1064	29	1051	49	1
HorselegFine_58	1005	25	1020	43	1
HorselegFine_59	495	18	491	19	1
HorselegFine_60	4845	45	4990	190	3
HorselegFine_61	583	29	383	24	34
HorselegFine_62	1412	32	1472	70	4
HorselegFine_63	1270	30	1103	41	13
HorselegFine_64	1078	23	1082	37	0
HorselegFine_65	1030	21	1050	38	2
HorselegFine_66	1037	31	1059	56	2
HorselegFine_67	975	29	976	39	0
HorselegFine_68	475	15	473	20	0
HorselegFine_69	492	18	479	21	3
HorselegFine_70	872	25	693	32	21
HorselegFine_71	464	14	441	19	5
HorselegFine_72	2573	36	2593	90	1
HorselegFine_73	1449	32	1499	65	3
HorselegFine_74	1046	30	1047	50	0
HorselegFine_75	1076	27	997	44	7
HorselegFine_76	456	16	456	17	0
HorselegFine_77	1502	34	1633	67	9
HorselegFine_78	570	21	408	20	28
HorselegFine_79	1135	35	1077	54	5
HorselegFine_80	2694	42	2700	110	0
HorselegFine_81	1472	31	1492	54	1
HorselegFine_82	1099	22	1125	40	2
HorselegFine_83	1620	36	1588	76	2
HorselegFine_84	1067	36	868	45	19
HorselegFine_85	477	18	467	24	2
HorselegFine_86	1429	33	1407	64	2
HorselegFine_87	964	29	703	35	27
HorselegFine_88	1039	26	1046	46	1
HorselegFine_89	484	18	404	21	17
HorselegFine_90	459	15	461	19	0
HorselegFine_91	1116	27	940	41	16
HorselegFine_92	1114	30	1120	54	1
HorselegFine_93	1439	37	1460	69	1
HorselegFine_94	1049	26	1067	45	2
HorselegFine_95	1036	27	969	43	6
HorselegFine_96	879	21	677	22	23
HorselegFine_97	1677	29	1543	59	8
HorselegFine_98	1214	36	1153	53	5

HorselegFine_99	1060	29	1074	48	1
HorselegFine_100	1366	29	1388	50	2
HorselegFine_101	1423	29	1320	56	7
HorselegFine_102	1428	31	1290	54	10
HorselegFine_103	1495	33	1481	66	1
HorselegFine_104	1386	32	1395	66	1
HorselegFine_105	1150	28	1146	58	0
HorselegFine_106	1069	27	980	44	8
HorselegFine_107	1258	64	1152	57	8
HorselegFine_108	1040	24	1022	39	2
HorselegFine_109	1039	29	1041	44	0
HorselegFine_110	1020	25	1024	42	0
HorselegFine_111	1082	25	1103	46	2
HorselegFine_112	1072	25	1072	42	0
HorselegFine_113	1383	34	1363	56	1
HorselegFine_114	874	25	733	39	16
HorselegFine_115	1153	31	1162	48	1
HorselegFine_116	1057	26	1062	43	0
HorselegFine_117	1248	23	1206	46	3
HorselegFine_118	1061	32	1004	56	5
HorselegFine_119	1173	35	1153	48	2
HorselegFine_120	1388	25	1397	45	1
HorselegFine_121	1319	31	1245	56	6
HorselegFine_122	1063	23	1067	48	0
HorselegFine_123	1108	31	1065	44	4
HorselegFine_124	1164	33	1182	56	2
HorselegFine_125	1106	27	1126	43	2
HorselegFine_126	1172	30	1051	50	10
HorselegFine_127	1448	31	1418	59	2
HorselegFine_128	473	15	464	20	2
HorselegFine_129	1368	31	1301	59	5
HorselegFine_130	504	18	453	22	10
HorselegFine_131	1035	25	1043	43	1
HorselegFine_132	1134	28	995	42	12
HorselegFine_133	1469	31	1476	61	0
HorselegFine_134	1101	24	1099	47	0
HorselegFine_135	860	44	684	54	20
HorselegFine_136	1161	29	1173	42	1
HorselegFine_137	523	19	488	19	7
HorselegFine_138	921	32	622	35	32
HorselegFine_139	964	33	826	44	14
HorselegFine_140	1454	31	1438	58	1
HorselegFine_141	1070	23	1076	40	1
HorselegFine_142	1262	30	1247	56	1

HorselegFine_143	1051	25	1042	41	1
HorselegFine_144	1078	27	943	42	13
HorselegFine_145	1447	26	1418	49	2
HorselegFine_146	474	16	467	19	1
HorselegFine_147	1331	27	1241	57	7
HorselegFine_148	570	20	305	17	46
HorselegFine_149	659	29	491	36	25
HorselegFine_150	1061	26	1068	47	1
HorselegFine_151	1072	24	1088	46	1
HorselegFine_152	1064	32	1057	55	1
HorselegFine_153	1032	34	1029	54	0
HorselegFine_154	1032	25	1059	43	3
HorselegFine_155	1064	32	1035	39	3

Table A3. U-Pb Ages: Dirtseller Mountain, AL Section

Sample ID	$^{207}Pb/^{235}U$ (Ma)	±2σ (Ma)	$^{206}Pb/^{238}U$ (Ma)	±2σ (Ma)	Discordance (%)
Plug 4					
DirtsellerMtn_1	461	12	447	12	3
DirtsellerMtn_2	781	25	489	18	37
DirtsellerMtn_3	448	11	448	14	0
DirtsellerMtn_4	1425	23	1405	42	1
DirtsellerMtn_5	1069	24	1008	31	6
DirtsellerMtn_6	447	12	446	13	0
DirtsellerMtn_7	1183	32	705	24	40
DirtsellerMtn_8	1020	20	1020	28	0
DirtsellerMtn_9	1696	85	1481	56	13
DirtsellerMtn_10	1393	28	1342	41	4
DirtsellerMtn_11	1082	23	1039	28	4
DirtsellerMtn_12	464	11	459	11	1
DirtsellerMtn_13	1008	18	1009	27	0
DirtsellerMtn_14	446	10	438	12	2
DirtsellerMtn_15	453	11	457	13	1
DirtsellerMtn_16	2270	180	1250	160	45
DirtsellerMtn_17	1054	22	1047	31	1
DirtsellerMtn_18	644	25	463	15	28
DirtsellerMtn_19	1019	20	1016	31	0
DirtsellerMtn_20	777	18	719	21	7
DirtsellerMtn_21	1190	24	1170	34	2
DirtsellerMtn_22	991	20	1006	28	2
DirtsellerMtn_23	438	12	439	14	0
DirtsellerMtn_24	1212	21	1225	30	1
DirtsellerMtn_25	1306	23	1305	34	0
DirtsellerMtn_26	2051	30	753	19	63
DirtsellerMtn_27	768	26	474	13	38
DirtsellerMtn_28	449	11	452	12	1
DirtsellerMtn_29	446	12	443	12	1
DirtsellerMtn_30	1002	20	1006	28	0
DirtsellerMtn_31	457	19	465	17	2
DirtsellerMtn_32	460	11	443	12	4
DirtsellerMtn_33	1001	18	1012	26	1
DirtsellerMtn_34	473	13	451	15	5
DirtsellerMtn_35	1093	19	1077	27	1
DirtsellerMtn_36	440	10	447	11	2
DirtsellerMtn_37	1045	20	1053	28	1
DirtsellerMtn_38	1097	18	1081	27	1
DirtsellerMtn_39	446	13	442	14	1
DirtsellerMtn_40	451	11	447	12	1

DirtsellerMtn_41	1609	24	1513	39	6
DirtsellerMtn_42	448	12	444	12	1
DirtsellerMtn_43	606	19	518	16	15
DirtsellerMtn_44	446	11	452	13	1
DirtsellerMtn_45	1350	23	1353	35	0
DirtsellerMtn_46	1170	110	569	31	51
DirtsellerMtn_47	994	18	992	26	0
DirtsellerMtn_48	450	11	453	13	1
DirtsellerMtn_49	1161	21	1164	29	0
DirtsellerMtn_50	1430	26	1419	38	1
DirtsellerMtn_51	583	21	542	19	7
DirtsellerMtn_52	1227	21	1223	32	0
DirtsellerMtn_53	1043	20	1032	26	1
DirtsellerMtn_54	992	45	515	16	48
DirtsellerMtn_55	1219	21	1216	27	0
DirtsellerMtn_56	1378	20	1351	29	2
DirtsellerMtn_57	1068	20	1074	28	1
DirtsellerMtn_58	483	11	445	11	8
DirtsellerMtn_59	930	18	941	25	1
DirtsellerMtn_60	981	20	919	24	6
DirtsellerMtn_61	1062	21	1027	24	3
DirtsellerMtn_62	439	11	448	10	2
DirtsellerMtn_63	1098	21	1079	28	2
DirtsellerMtn_64	643	29	476	13	26
DirtsellerMtn_65	568	13	466	13	18
DirtsellerMtn_66	1026	19	1038	26	1
DirtsellerMtn_67	437	10	438	11	0
DirtsellerMtn_68	575	12	556	13	3
DirtsellerMtn_69	1368	20	1358	31	1
DirtsellerMtn_70	989	18	996	24	1
DirtsellerMtn_71	1183	25	1118	31	5
DirtsellerMtn_72	1000	18	994	25	1
DirtsellerMtn_73	452	12	447	13	1
DirtsellerMtn_74	467	12	449	13	4
DirtsellerMtn_75	466	13	459	14	2
DirtsellerMtn_76	953	12	915	18	4
DirtsellerMtn_77	1042	16	1030	20	1
DirtsellerMtn_78	1196	23	1115	27	7
DirtsellerMtn_79	450	9	454	11	1
DirtsellerMtn_80	1292	16	1214	27	6
DirtsellerMtn_81	444	8	446	10	0
DirtsellerMtn_82	462	10	456	12	1
DirtsellerMtn_83	508	12	496	14	2
DirtsellerMtn_84	460	11	439	12	5

DirtsellerMtn_85	502	14	458	10	9
DirtsellerMtn_86	980	19	976	25	0
DirtsellerMtn_87	943	14	759	13	20
DirtsellerMtn_88	2669	26	2655	55	1
DirtsellerMtn_89	1837	34	876	23	52
DirtsellerMtn_90	447	12	460	13	3
Plug 8					
Dirtseller_1	448	15	458	20	2
Dirtseller_2	478	19	417	19	13
Dirtseller_3	1091	28	1104	49	1
Dirtseller_4	1011	18	1025	35	1
Dirtseller_5	997	24	1012	38	2
Dirtseller_6	1476	29	1483	51	0
Dirtseller_7	886	30	844	41	5
Dirtseller_8	1419	34	1426	62	0
Dirtseller_9	1180	26	1170	38	1
Dirtseller_10	475	16	475	20	0
Dirtseller_11	1040	24	901	38	13
Dirtseller_12	474	17	451	18	5
Dirtseller_13	1145	25	1143	46	0
Dirtseller_14	2224	78	930	66	58
Dirtseller_15	1050	26	1052	41	0
Dirtseller_16	986	31	979	47	1
Dirtseller_17	1055	28	1052	46	0
Dirtseller_18	1036	27	1054	42	2
Dirtseller_19	453	15	451	21	0
Dirtseller_20	860	28	460	20	47
Dirtseller_21	2622	81	1044	74	60
Dirtseller_22	1106	27	1110	48	0
Dirtseller_23	467	17	463	18	1
Dirtseller_24	1095	29	1007	46	8
Dirtseller_25	5640	65	7860	360	39
Dirtseller_26	464	17	448	21	3
Dirtseller_27	1063	26	1085	43	2
Dirtseller_28	1001	27	998	37	0
Dirtseller_29	473	19	417	18	12
Dirtseller_30	1341	30	1341	52	0
Dirtseller_31	1703	58	1157	47	32
Dirtseller_32	530	23	462	16	13
Dirtseller_33	1128	28	1093	45	3
Dirtseller_34	449	12	456	16	2
Dirtseller_35	2024	74	601	31	70
Dirtseller_36	965	32	706	35	27
Dirtseller_37	445	20	435	19	2

Dirtseller_38	475	16	463	19	3
Dirtseller_39	1240	34	1056	51	15
Dirtseller_40	1373	36	1290	59	6
Dirtseller_41	1439	31	1439	59	0
Dirtseller_42	463	15	459	20	1
Dirtseller_43	1180	31	1188	50	1
Dirtseller_44	866	58	744	54	14
Dirtseller_45	480	19	470	19	2
Dirtseller_46	1316	48	1267	60	4
Dirtseller_47	1110	25	942	34	15
Dirtseller_48	3573	73	1960	120	45
Dirtseller_49	435	16	456	19	5
Dirtseller_50	998	25	1000	37	0
Dirtseller_51	450	15	448	17	0
Dirtseller_52	1663	30	1646	65	1
Dirtseller_53	476	18	472	23	1
Dirtseller_54	1155	24	1158	40	0
Dirtseller_55	1187	42	691	42	42
Dirtseller_56	1048	35	989	44	6
Dirtseller_57	997	25	986	37	1
Dirtseller_58	461	18	464	21	1
Dirtseller_59	456	16	462	19	1
Dirtseller_60	1117	35	994	50	11
Dirtseller_61	1299	27	1291	39	1
Dirtseller_62	1310	37	1149	51	12
Dirtseller_63	1028	28	1034	41	1
Dirtseller_64	998	22	1007	36	1
Dirtseller_65	1050	28	1021	43	3
Dirtseller_66	1095	26	1100	40	0
Dirtseller_67	1059	28	1067	38	1
Dirtseller_68	3416	96	2050	170	40
Dirtseller_69	1044	22	1051	30	1
Dirtseller_70	3875	39	2341	84	40
Dirtseller_71	453	13	442	16	2
Dirtseller_72	1041	25	1036	34	0
Dirtseller_73	454	19	427	19	6
Dirtseller_74	1100	27	1101	45	0
Dirtseller_75	1170	24	1154	45	1
Dirtseller_76	1123	30	1110	40	1
Dirtseller_77	986	26	942	39	4
Dirtseller_78	1052	26	1057	38	0
Dirtseller_79	1293	31	1217	49	6
Dirtseller_80	1156	31	1180	46	2
Dirtseller_81	1090	170	567	40	48

Dirtseller_82	968	23	969	37	0
Dirtseller_83	1225	35	1003	35	18
Dirtseller_84	454	19	466	22	3
Dirtseller_85	1562	28	1329	42	15
Dirtseller_86	1248	27	1251	52	0
Dirtseller_87	1038	26	1031	38	1
Dirtseller_88	1168	23	1165	40	0
Dirtseller_89	612	36	574	37	6
Dirtseller_90	1154	23	1148	39	1
Dirtseller_91	1110	27	1124	42	1
Dirtseller_92	915	34	872	47	5
Dirtseller_93	1815	37	1271	60	30
Dirtseller_94	1033	24	996	35	4
Dirtseller_95	1356	31	1323	57	2
Dirtseller_96	452	17	448	17	1
Dirtseller_97	1011	22	1007	34	0
Dirtseller_98	1011	24	1006	38	0

Table A4. U-Pb Ages: Reed Road, GA Section

Sample ID	**$^{207}Pb/^{235}U$ (Ma)**	**±2σ (Ma)**	**$^{206}Pb/^{238}U$ (Ma)**	**±2σ (Ma)**	**Discordance (%)**
LA 20150810 Reed Road					
ReedRoadSst_1	1185	13	1019	13	14
ReedRoadSst_2	1387	21	1364	18	2
ReedRoadSst_3	1303	21	1247	19	4
ReedRoadSst_4	1179	18	1168	17	1
ReedRoadSst_5	1091	20	980	19	10
ReedRoadSst_6	1106	29	1124	23	2
ReedRoadSst_7	1108	19	1077	16	3
ReedRoadSst_8	1450	20	1375	24	5
ReedRoadSst_9	1198	15	1192	15	1
ReedRoadSst_10	1229	15	1128	13	8
ReedRoadSst_11	1196	16	1108	15	7
ReedRoadSst_12	1482	21	1321	22	11
ReedRoadSst_13	1115	18	1034	15	7
ReedRoadSst_14	1184	16	1185	17	0
ReedRoadSst_15	1526	19	1400	19	8
ReedRoadSst_16	1188	21	1167	16	2
ReedRoadSst_17	1589	33	1330	23	16
ReedRoadSst_18	1030	15	1026	13	0
ReedRoadSst_19	1058	13	993	12	6
ReedRoadSst_20	1182	18	1099	15	7
ReedRoadSst_21	1266	19	954	16	25
ReedRoadSst_22	1184	20	1120	14	5
ReedRoadSst_23	1330	35	1184	18	11
ReedRoadSst_24	1371	12	1274	15	7
ReedRoadSst_25	1414	13	1370	16	3
ReedRoadSst_26	1500	27	1231	18	18
ReedRoadSst_27	761	28	467	9	39
ReedRoadSst_28	1001	20	978	13	2
ReedRoadSst_29	1414	20	1379	19	2
ReedRoadSst_30	1266	28	1187	18	6
ReedRoadSst_31	1589	14	1525	19	4
ReedRoadSst_32	1208	14	1190	14	1
ReedRoadSst_33	1462	21	1325	19	9
ReedRoadSst_34	1535	21	1375	20	10
ReedRoadSst_35	1120	25	1041	15	7
ReedRoadSst_36	1418	15	1353	17	5
ReedRoadSst_37	1565	13	646	12	59
ReedRoadSst_38	650	8	355	6	45
ReedRoadSst_39	1267	13	1198	15	5
ReedRoadSst_40	1169	15	1114	14	5

ReedRoadSst_41	1045	15	1028	13	2
ReedRoadSst_42	1343	27	1075	16	20
ReedRoadSst_43	1447	20	994	14	31
ReedRoadSst_44	1284	14	1251	16	3
ReedRoadSst_45	1178	13	1140	15	3
ReedRoadSst_46	1023	21	1009	13	1
ReedRoadSst_47	1483	21	1459	18	2
ReedRoadSst_48	1154	9	922	8	20
ReedRoadSst_49	1486	21	1356	17	9
ReedRoadSst_50	1408	23	1383	18	2
ReedRoadSst_51	1048	21	969	14	8
ReedRoadSst_52	1354	16	1240	15	8
ReedRoadSst_53	1089	16	1065	15	2
ReedRoadSst_54	1414	19	1374	18	3
ReedRoadSst_55	1225	38	1144	28	7
ReedRoadSst_56	1141	23	999	13	12
ReedRoadSst_57	1030	14	968	13	6
ReedRoadSst_58	1154	15	1138	13	1
ReedRoadSst_59	1465	14	1256	17	14
ReedRoadSst_60	1171	14	1159	14	1
ReedRoadSst_61	1032	24	1029	15	0
ReedRoadSst_62	1735	16	1655	19	5
ReedRoadSst_63	1139	12	1086	10	5
ReedRoadSst_64	695	24	531	18	24
ReedRoadSst_65	1204	14	1143	16	5
ReedRoadSst_66	990	12	555	9	44
ReedRoadSst_67	401	19	409	6	2
ReedRoadSst_68	392	19	405	8	3
ReedRoadSst_69	399	18	405	7	1
ReedRoadSst_70	1088	28	1065	16	2
ReedRoadSst_71	1043	28	1050	17	1
ReedRoadSst_72	1054	31	1052	18	0
ReedRoadSst_73	1070	22	1065	14	0
ReedRoadSst_74	1047	33	1053	20	1
ReedRoadSst_75	411	13	414	6	1
ReedRoadSst_76	423	12	415	6	2
ReedRoadSst_77	420	14	421	6	0
ReedRoadSst_78	420	16	418	6	1
ReedRoadSst_79	414	14	413	6	0

Table A5. U-Pb Ages: Dodson Mountain, TN Section

Sample ID	$^{207}Pb/^{235}U$ (Ma)	±2σ (Ma)	$^{206}Pb/^{238}U$ (Ma)	±2σ (Ma)	Discordance (%)
Plug 6-Bed 4 (1st Run)					
Dodson1stsc_1	1132	16	1126	28	1
Dodson1stsc_2	1437	19	1423	34	1
Dodson1stsc_3	1363	13	1343	18	1
Dodson1stsc_4	1290	20	1129	21	12
Dodson1stsc_5	1458	15	1463	19	0
Dodson1stsc_6	1471	13	1375	21	7
Dodson1stsc_7	1375	16	1359	22	1
Dodson1stsc_8	1960	100	1397	42	29
Dodson1stsc_9	1440	20	1380	22	4
Dodson1stsc_10	1427	20	1387	31	3
Dodson1stsc_11	2685	14	2684	27	0
Dodson1stsc_12	1750	12	1593	33	9
Dodson1stsc_13	967	24	825	34	15
Dodson1stsc_14	723	15	456	16	37
Dodson1stsc_15	1452	14	1447	22	0
Dodson1stsc_16	1506	48	1143	19	24
Dodson1stsc_17	1173	21	1151	23	2
Dodson1stsc_18	1153	12	1131	16	2
Dodson1stsc_19	1251	17	1227	25	2
Dodson1stsc_20	1699	24	1207	23	29
Dodson1stsc_21	1365	23	1357	36	1
Dodson1stsc_22	1883	29	1308	32	31
Dodson1stsc_23	2263	52	1190	28	47
Dodson1stsc_24	1126	13	1130	20	0
Dodson1stsc_25	1558	30	1107	24	29
Dodson1stsc_26	1739	42	1151	27	34
Dodson1stsc_27	1460	14	1441	26	1
Dodson1stsc_28	1744	16	1731	32	1
Dodson1stsc_29	1267	18	1163	23	8
Dodson1stsc_30	1402	22	1366	32	3
Dodson1stsc_31	1179	13	1186	22	1
Dodson1stsc_32	1462	32	1173	22	20
Dodson1stsc_33	993	19	974	27	2
Dodson1stsc_34	1443	25	1400	34	3
Dodson1stsc_35	2669	20	2643	43	1
Dodson1stsc_36	1484	17	1151	21	22
Dodson1stsc_37	1127	16	1033	23	8
Dodson1stsc_38	1757	28	1099	31	37
Dodson1stsc_39	1528	15	1487	29	3
Dodson1stsc_40	2227	43	1557	53	30

Dodson1stsc_41	1806	67	1312	27	27
Dodson1stsc_42	1371	38	1180	33	14
Dodson1stsc_43	1638	18	1573	33	4
Dodson1stsc_44	1561	19	1340	31	14
Dodson1stsc_45	1212	27	1122	27	7
Dodson1stsc_46	1174	24	1112	31	5
Dodson1stsc_47	1082	19	1028	27	5
Dodson1stsc_48	1463	15	1450	30	1
Dodson1stsc_49	1059	16	1066	29	1
Dodson1stsc_50	1189	24	1084	31	9
Dodson1stsc_51	1385	30	1124	26	19
Dodson1stsc_52	1237	18	1216	29	2
Dodson1stsc_53	1456	22	1411	31	3
Dodson1stsc_54	1184	17	1119	25	5
Dodson1stsc_55	1159	16	1139	25	2
Dodson1stsc_56	1467	25	1437	40	2
Dodson1stsc_57	1331	22	1167	32	12
Dodson1stsc_58	1715	34	1405	34	18
Dodson1stsc_59	1866	45	876	32	53
Dodson1stsc_60	1523	28	1451	33	5
Dodson1stsc_61	1554	22	1453	35	6
Dodson1stsc_62	1467	23	1450	43	1
Dodson1stsc_63	1989	28	1213	29	39
Dodson1stsc_64	1146	17	1138	33	1
Dodson1stsc_65	1235	18	1208	29	2
Dodson1stsc_66	1425	21	1407	32	1
Dodson1stsc_67	1101	25	1079	39	2
Dodson1stsc_68	1453	26	1469	38	1
Dodson1stsc_69	1293	33	1279	45	1
Dodson1stsc_70	1044	16	1038	18	1
Dodson1stsc_71	1164	25	1117	22	4
Dodson1stsc_72	1313	20	1287	26	2
Dodson1stsc_73	1259	23	1161	26	8
Dodson1stsc_74	1093	18	1078	28	1
Dodson1stsc_75	1294	28	1075	29	17
Dodson1stsc_76	1570	34	731	28	53
Dodson1stsc_77	1340	24	1323	39	1
Dodson1stsc_78	1420	28	1361	40	4
Dodson1stsc_79	1296	18	1299	34	0
Dodson1stsc_80	1246	20	776	29	38
Dodson1stsc_81	3099	78	1827	77	41
Dodson1stsc_82	1916	37	873	31	54
Dodson1stsc_83	1067	21	953	33	11
Dodson1stsc_84	1423	24	1429	47	0

Dodson1stsc_85	1177	30	1100	29	7
Dodson1stsc_86	1402	20	1371	33	2
Dodson1stsc_87	2291	35	1881	68	18
Dodson1stsc_88	1458	20	1463	36	0
Dodson1stsc_89	1225	26	1122	31	8
Dodson1stsc_90	1953	29	1508	43	23
Dodson1stsc_91	1960	50	1306	32	33
Dodson1stsc_92	955	19	650	22	32
Dodson1stsc_93	1036	15	1033	25	0
Dodson1stsc_94	1464	20	1429	38	2
Dodson1stsc_95	2143	33	1280	48	40
Dodson1stsc_96	1462	23	1429	39	2
Dodson1stsc_97	1791	24	1039	30	42
Dodson1stsc_98	1356	23	1327	31	2
Dodson1stsc_99	975	25	971	30	0
Dodson1stsc_100	1264	31	1135	40	10
Plug 6-Bed 4 (2nd Run)					
Dodson1stsc_1	1419	22	1439	40	1
Dodson1stsc_2	1226	19	1231	29	0
Dodson1stsc_3	1335	21	1333	39	0
Dodson1stsc_4	1076	22	1087	39	1
Dodson1stsc_5	1085	23	1066	34	2
Dodson1stsc_6	1325	26	1102	39	17
Dodson1stsc_7	1617	59	1128	39	30
Dodson1stsc_8	1708	44	1186	41	31
Dodson1stsc_9	1493	37	1292	47	13
Dodson1stsc_10	1293	30	1265	62	2
Dodson1stsc_11	1356	33	1343	48	1
Dodson1stsc_12	1145	37	901	39	21
Dodson1stsc_13	1706	34	1384	47	19
Dodson1stsc_14	1369	29	1328	51	3
Dodson1stsc_15	1031	23	1046	36	1
Dodson1stsc_16	1192	26	1096	32	8
Dodson1stsc_17	1236	18	1223	30	1
Dodson1stsc_18	1229	29	660	26	46
Dodson1stsc_19	1035	20	1022	32	1
Dodson1stsc_20	1262	22	1249	35	1
Dodson1stsc_21	1944	31	1149	54	41
Dodson1stsc_22	1226	21	1240	34	1
Dodson1stsc_23	1342	23	1015	31	24
Dodson1stsc_24	1466	20	1479	41	1
Dodson1stsc_25	1675	36	1302	38	22
Dodson1stsc_26	1294	21	1319	33	2
Dodson1stsc_27	1166	24	1135	37	3

Dodson1stsc_28	1116	17	1157	32	4
Plug 7-Bed 4					
Dodson1stsc_1	656	16	381	13	42
Dodson1stsc_2	1448	27	1468	56	1
Dodson1stsc_3	1320	23	1311	44	1
Dodson1stsc_4	1489	28	1170	47	21
Dodson1stsc_5	1385	34	1351	65	2
Dodson1stsc_6	1476	26	1465	50	1
Dodson1stsc_7	1776	28	1482	52	17
Dodson1stsc_8	1081	25	1088	36	1
Dodson1stsc_9	1161	38	1145	44	1
Dodson1stsc_10	1133	30	1104	41	3
Dodson1stsc_11	1435	44	1191	47	17
Dodson1stsc_12	1054	23	1072	41	2
Dodson1stsc_13	1035	24	1026	36	1
Dodson1stsc_14	1268	21	1275	35	1
Dodson1stsc_15	1311	32	1239	39	5
Dodson1stsc_16	1166	27	1177	43	1
Dodson1stsc_17	1025	23	1020	30	0
Dodson1stsc_18	1162	27	1188	42	2
Dodson1stsc_19	1351	25	1217	44	10
Dodson1stsc_20	1079	26	1079	36	0
Dodson1stsc_21	1155	23	1146	36	1
Dodson1stsc_22	1249	26	1212	40	3
Dodson1stsc_23	1279	24	1259	40	2
Dodson1stsc_24	1984	39	1336	43	33
Dodson1stsc_25	1259	32	1188	50	6
Dodson1stsc_26	1163	26	1170	40	1
Dodson1stsc_27	1532	40	1204	52	21
Dodson1stsc_28	2540	160	1960	130	23
Dodson1stsc_29	1603	34	928	52	42
Dodson1stsc_30	1241	29	1277	55	3
Dodson1stsc_31	954	22	966	35	1
Dodson1stsc_32	1208	27	1145	44	5
Dodson1stsc_33	1027	31	1007	43	2
Dodson1stsc_34	1486	29	1127	44	24
Dodson1stsc_35	1040	29	1070	39	3
Dodson1stsc_36	1355	25	1163	44	14
Dodson1stsc_37	1173	30	1149	39	2
Dodson1stsc_38	1102	25	1091	38	1
Dodson1stsc_39	1140	34	1149	54	1
Dodson1stsc_40	1485	53	1336	89	10
Dodson1stsc_41	1858	49	1286	48	31
Dodson1stsc_42	2316	39	1001	35	57

Dodson1stsc_43	1090	25	1067	28	2
Dodson1stsc_44	1076	24	1067	42	1
Dodson1stsc_45	1359	27	1345	45	1
Dodson1stsc_46	922	27	722	33	22
Dodson1stsc_47	977	23	983	38	1
Dodson1stsc_48	1152	21	1157	37	0
Dodson1stsc_49	1887	38	1082	40	43
Dodson1stsc_50	1346	23	1389	48	3
Dodson1stsc_51	1494	23	1360	43	9
Dodson1stsc_52	1317	27	1305	43	1
Dodson1stsc_53	464	15	328	15	29
Dodson1stsc_54	1514	31	1438	53	5
Dodson1stsc_55	1613	30	1158	36	28
Plug 7-Bed 7					
Dodson2ndsc_1	1413	28	1417	54	0
Dodson2ndsc_2	1438	22	1443	45	0
Dodson2ndsc_3	1470	26	1457	48	1
Dodson2ndsc_4	1105	22	1118	36	1
Dodson2ndsc_5	978	45	960	44	2
Dodson2ndsc_6	1462	24	1451	45	1
Dodson2ndsc_7	1043	21	1049	36	1
Dodson2ndsc_8	1716	41	1552	46	10
Dodson2ndsc_9	1018	21	1009	31	1
Dodson2ndsc_10	1308	27	1302	47	0
Dodson2ndsc_11	1147	24	394	16	66
Dodson2ndsc_12	1261	24	1287	48	2
Dodson2ndsc_13	2335	35	2120	67	9
Dodson2ndsc_14	1042	29	1036	41	1
Dodson2ndsc_15	1041	21	1047	35	1
Dodson2ndsc_16	1182	24	1176	41	1
Dodson2ndsc_17	2117	49	1412	47	33
Dodson2ndsc_18	1100	27	1117	33	2
Dodson2ndsc_19	1124	24	1143	41	2
Dodson2ndsc_20	1362	26	1256	48	8
Dodson2ndsc_21	1371	23	1299	63	5
Dodson2ndsc_22	1441	22	1454	49	1
Dodson2ndsc_23	1191	27	1218	47	2
Dodson2ndsc_24	1031	25	1030	37	0
Dodson2ndsc_25	1160	22	1154	38	1
Dodson2ndsc_26	1494	32	1296	49	13
Dodson2ndsc_27	1471	26	1356	41	8
Dodson2ndsc_28	1700	21	1568	44	8
Dodson2ndsc_29	1094	31	1136	36	4
Dodson2ndsc_30	1674	41	882	45	47

Dodson2ndsc_31	1324	31	1187	38	10
Dodson2ndsc_32	1303	27	1178	40	10
Dodson2ndsc_33	1930	40	704	25	64
Dodson2ndsc_34	1473	31	845	49	43
Dodson2ndsc_35	1335	33	1207	46	10
Dodson2ndsc_36	1136	31	1176	44	4
Dodson2ndsc_37	1160	25	1149	40	1
Dodson2ndsc_38	1760	130	1218	52	31
Dodson2ndsc_39	1153	28	1152	44	0
Dodson2ndsc_40	1072	25	1085	39	1
Dodson2ndsc_41	1184	32	1166	44	2
Dodson2ndsc_42	1587	36	922	33	42
Dodson2ndsc_43	1013	19	1013	33	0
Dodson2ndsc_44	1073	15	1084	27	1
Dodson2ndsc_45	596	16	571	16	4
Dodson2ndsc_46	1054	20	1082	32	3
Dodson2ndsc_47	1182	17	1120	31	5
Dodson2ndsc_48	1207	21	1236	37	2
Dodson2ndsc_49	1041	20	1055	33	1
Dodson2ndsc_50	1234	32	812	35	34
Dodson2ndsc_51	1156	32	1182	51	2
Dodson2ndsc_52	1761	34	926	36	47
Dodson2ndsc_53	1016	22	1027	34	1
Dodson2ndsc_54	1431	31	1431	53	0
Dodson2ndsc_55	1142	31	1154	52	1
Dodson2ndsc_56	1175	21	1198	40	2
Dodson2ndsc_57	1379	29	1371	53	1
Dodson2ndsc_58	1126	24	1135	43	1
Dodson2ndsc_59	1293	25	1181	32	9
Dodson2ndsc_60	1396	24	1352	46	3
Dodson2ndsc_61	1030	15	1052	27	2
Dodson2ndsc_62	998	24	1031	29	3
Dodson2ndsc_63	1429	26	1303	46	9
Dodson2ndsc_64	1400	24	1403	49	0
Dodson2ndsc_65	1438	29	1461	56	2
Dodson2ndsc_66	1435	27	1433	41	0
Dodson2ndsc_67	1045	19	1053	31	1
Dodson2ndsc_68	1090	24	1093	32	0
Dodson2ndsc_69	1013	22	1011	32	0
Dodson2ndsc_70	1638	25	1633	50	0
Dodson2ndsc_71	1152	23	1161	36	1
Dodson2ndsc_72	1024	21	1045	35	2
Dodson2ndsc_73	1455	25	548	20	62
Dodson2ndsc_74	1023	20	1038	32	1

Dodson2ndsc_75	1461	66	1148	35	21
Dodson2ndsc_76	969	21	985	30	2
Dodson2ndsc_77	1316	24	450	19	66
Dodson2ndsc_78	1480	22	1491	32	1
Dodson2ndsc_79	1366	29	404	20	70
Dodson2ndsc_80	1190	29	638	29	46
Dodson2ndsc_81	1423	23	1404	45	1
Dodson2ndsc_82	2689	26	2696	69	0
Dodson2ndsc_83	1159	24	1178	41	2
Dodson2ndsc_84	1403	24	1308	43	7
Dodson2ndsc_85	1146	19	1152	27	1
Dodson2ndsc_86	1496	29	611	26	59
Dodson2ndsc_87	1138	21	1146	36	1
Dodson2ndsc_88	1054	20	1053	32	0
Dodson2ndsc_89	1209	22	1229	39	2
Dodson2ndsc_90	1560	23	1483	36	5
Dodson2ndsc_91	1775	22	1799	43	1
Dodson2ndsc_92	1219	20	1213	36	0
Dodson2ndsc_93	1612	30	1407	33	13
Dodson2ndsc_94	1634	29	1626	49	0
Dodson2ndsc_95	983	15	979	27	0
Dodson2ndsc_96	1041	20	1033	37	1
Dodson2ndsc_97	1196	21	1170	37	2
Dodson2ndsc_98	1176	19	1194	30	2
Dodson2ndsc_99	1071	22	1072	29	0
Dodson2ndsc_100	1444	25	1450	53	0
Dodson2ndsc_101	1711	31	563	24	67
Dodson2ndsc_102	1016	25	1012	35	0
Dodson2ndsc_103	1202	20	1195	32	1
Dodson2ndsc_104	2638	30	2557	76	3
Dodson2ndsc_105	1160	23	1176	41	1
Dodson2ndsc_106	1188	20	1011	26	15
Dodson2ndsc_107	1048	20	1054	33	1
Dodson2ndsc_108	1580	80	906	37	43
Dodson2ndsc_109	1185	17	1175	37	1
Dodson2ndsc_110	1128	23	1158	37	3
Dodson2ndsc_111	1098	23	1016	28	7
Dodson2ndsc_112	1304	26	1188	39	9
Dodson2ndsc_113	1533	31	1443	52	6
Dodson2ndsc_114	1211	34	1095	42	10
Dodson2ndsc_115	1167	20	1170	35	0
Dodson2ndsc_116	1195	17	1182	33	1
Dodson2ndsc_117	1168	21	1174	38	1
Dodson2ndsc_118	982	21	991	25	1

Dodson2ndsc_119	1162	21	1158	33	0
Dodson2ndsc_120	1169	20	1176	33	1
Dodson2ndsc_121	1180	21	1186	36	1
Dodson2ndsc_122	1196	22	1103	34	8
Dodson2ndsc_123	1159	18	1171	32	1
Dodson2ndsc_124	1492	45	564	21	62
Dodson2ndsc_125	1448	23	1435	46	1
Dodson2ndsc_126	1415	23	1395	39	1
Dodson2ndsc_127	1408	25	1404	42	0
Dodson2ndsc_128	1350	20	1363	37	1
Dodson2ndsc_129	1050	20	1046	26	0
Dodson2ndsc_130	1623	23	672	23	59
Dodson2ndsc_131	1653	28	599	23	64
Dodson2ndsc_132	1141	25	1132	41	1
Dodson2ndsc_133	1010	18	995	29	1
Dodson2ndsc_134	1170	17	1172	33	0
Dodson2ndsc_135	1467	21	1467	40	0
Dodson2ndsc_136	1151	17	1174	35	2
Dodson2ndsc_137	1309	33	1200	32	8
Dodson2ndsc_138	1106	21	1108	36	0
Dodson2ndsc_139	1186	15	1178	28	1
Dodson2ndsc_140	1454	35	783	32	46
Dodson2ndsc_141	1323	28	1349	51	2
Dodson2ndsc_142	1262	24	1272	42	1
Dodson2ndsc_143	1519	35	1307	42	14
Dodson2ndsc_144	1196	21	1175	36	2
Dodson2ndsc_145	1014	21	1011	35	0
Dodson2ndsc_146	1183	21	1206	33	2
Dodson2ndsc_147	1431	22	1408	42	2
Dodson2ndsc_148	1585	32	1171	36	26
Dodson2ndsc_149	1260	24	1115	35	12
Dodson2ndsc_150	990	21	1006	31	2
Dodson2ndsc_151	1301	70	983	27	24
Dodson2ndsc_152	1028	16	1040	31	1
Dodson2ndsc_153	1139	23	1134	42	0
Dodson2ndsc_154	1006	26	1019	33	1
Dodson2ndsc_155	1181	37	972	32	18
Dodson2ndsc_156	1343	26	1346	43	0
Dodson2ndsc_157	934	21	950	35	2
Dodson2ndsc_158	1460	26	1466	48	0
Dodson2ndsc_159	1245	22	1252	38	1
Dodson2ndsc_160	1015	21	1017	33	0
Dodson2ndsc_161	1488	27	1453	43	2
Dodson2ndsc_162	1035	17	999	28	3

Dodson2ndsc_163	1495	22	1472	43	2
Dodson2ndsc_164	1166	19	1175	31	1
Dodson2ndsc_165	1155	19	1172	33	1
Dodson2ndsc_166	965	21	971	34	1
Dodson2ndsc_167	1106	21	1101	35	0
Dodson2ndsc_168	1235	19	1240	32	0
Dodson2ndsc_169	1301	26	630	24	52
Dodson2ndsc_170	1157	26	1077	35	7
Dodson2ndsc_171	1012	22	1017	39	0
Dodson2ndsc_172	1016	18	1027	32	1
Dodson2ndsc_173	1184	20	1203	35	2
Dodson2ndsc_174	1033	20	1043	34	1
Dodson2ndsc_175	1327	17	1328	31	0
Dodson2ndsc_176	1189	20	1156	35	3
Dodson2ndsc_177	1380	21	1312	42	5
Dodson2ndsc_178	2150	140	1433	91	33
Dodson2ndsc_179	1362	20	1356	42	0
Dodson2ndsc_180	1425	23	1072	33	25
Dodson2ndsc_181	1243	19	1159	31	7
Dodson2ndsc_182	1225	18	1223	31	0
Dodson2ndsc_183	1350	24	1353	42	0
Dodson2ndsc_184	1361	20	1356	32	0
Dodson2ndsc_185	685	17	693	21	1
Dodson2ndsc_186	1016	17	1023	27	1
Dodson2ndsc_187	994	14	1006	27	1
Dodson2ndsc_188	1383	22	1062	34	23
Dodson2ndsc_189	1133	24	1126	34	1
Dodson2ndsc_190	1070	18	1073	33	0
Dodson2ndsc_191	1156	19	1178	38	2
Dodson2ndsc_192	1331	23	1340	44	1
Dodson2ndsc_193	1045	18	1027	35	2
Dodson2ndsc_194	1080	20	1020	33	6
Dodson2ndsc_195	1230	21	1164	37	5
Dodson2ndsc_196	979	19	988	30	1
Dodson2ndsc_197	1427	23	1418	48	1
Dodson2ndsc_198	1555	21	628	32	60
Dodson2ndsc_199	1471	23	1488	42	1
Plug 7-Bed 37					
Oneof1stQtzArenites_1	1068	27	1037	39	3
Oneof1stQtzArenites_2	1149	16	1119	28	3
Oneof1stQtzArenites_3	493	15	465	16	6
Oneof1stQtzArenites_4	1066	17	1049	25	2
Oneof1stQtzArenites_5	1400	22	1359	34	3
Oneof1stQtzArenites_6	1206	26	917	39	24

Oneof1stQtzArenites_7	1061	16	1032	22	3
Oneof1stQtzArenites_8	1502	24	1501	40	0
Oneof1stQtzArenites_9	1438	19	1443	32	0
Oneof1stQtzArenites_10	1241	39	954	52	23
Oneof1stQtzArenites_11	1461	18	1470	33	1
Oneof1stQtzArenites_12	858	18	589	21	31
Oneof1stQtzArenites_13	1146	14	1122	21	2
Oneof1stQtzArenites_14	3740	78	2560	150	32
Oneof1stQtzArenites_15	1509	21	1406	26	7
Oneof1stQtzArenites_16	1622	16	1653	33	2
Oneof1stQtzArenites_17	1301	22	1212	36	7
Oneof1stQtzArenites_18	1162	13	1125	23	3
Oneof1stQtzArenites_19	1413	18	1336	34	5
Oneof1stQtzArenites_20	1197	14	1224	23	2
Oneof1stQtzArenites_21	6020	140	9820	660	63
Oneof1stQtzArenites_22	3005	86	1770	100	41
Oneof1stQtzArenites_23	2220	87	1273	73	43
Oneof1stQtzArenites_24	4662	69	4390	220	6
Oneof1stQtzArenites_25	3771	74	2540	140	33
Oneof1stQtzArenites_26	1190	16	1195	23	0
Oneof1stQtzArenites_27	1434	19	1419	28	1
Oneof1stQtzArenites_28	1220	24	1116	33	9
Oneof1stQtzArenites_29	846	27	458	30	46
Oneof1stQtzArenites_30	3143	66	1729	89	45
Oneof1stQtzArenites_31	1318	13	1313	22	0
Oneof1stQtzArenites_32	4207	63	3250	170	23
Oneof1stQtzArenites_33	1169	15	1140	27	2
Oneof1stQtzArenites_34	1338	26	1274	39	5
Oneof1stQtzArenites_35	1129	15	1126	24	0
Oneof1stQtzArenites_36	1337	25	1258	40	6
Oneof1stQtzArenites_37	1479	24	1489	45	1
Oneof1stQtzArenites_38	1305	28	1276	43	2
Oneof1stQtzArenites_39	1028	19	1023	30	0
Oneof1stQtzArenites_40	1110	17	1111	25	0
Oneof1stQtzArenites_41	1434	21	1145	32	20
Oneof1stQtzArenites_42	1237	21	1016	28	18
Oneof1stQtzArenites_43	1348	18	1375	29	2
Oneof1stQtzArenites_44	1288	20	1312	31	2
Oneof1stQtzArenites_45	2655	22	2630	52	1
Oneof1stQtzArenites_46	1027	21	904	24	12
Oneof1stQtzArenites_47	1118	16	1131	22	1
Oneof1stQtzArenites_48	1187	15	1198	23	1
Oneof1stQtzArenites_49	1690	110	1091	63	35
Oneof1stQtzArenites_50	4377	59	3720	150	15

Oneof1stQtzArenites_51	5179	81	5910	280	14
Oneof1stQtzArenites_52	1128	36	1003	48	11
Oneof1stQtzArenites_53	1367	83	1216	77	11
Oneof1stQtzArenites_54	1556	55	991	61	36
Oneof1stQtzArenites_55	1753	48	1066	53	39
Oneof1stQtzArenites_56	1392	27	1428	39	3
Oneof1stQtzArenites_57	1021	28	632	29	38
Oneof1stQtzArenites_58	1395	36	1051	51	25
Oneof1stQtzArenites_59	2868	53	1649	83	43
Oneof1stQtzArenites_60	3046	61	1800	110	41
Oneof1stQtzArenites_61	2578	72	1635	72	37
Oneof1stQtzArenites_62	2734	46	1519	59	44
Oneof1stQtzArenites_63	1951	39	1205	52	38
Oneof1stQtzArenites_64	2250	66	820	66	64
Oneof1stQtzArenites_65	1059	20	1073	34	1
Oneof1stQtzArenites_66	2957	56	1605	79	46
Oneof1stQtzArenites_67	1127	20	1047	32	7
Oneof1stQtzArenites_68	1319	25	1269	45	4
Oneof1stQtzArenites_69	5268	77	6310	290	20
Oneof1stQtzArenites_70	1444	21	1418	34	2
Oneof1stQtzArenites_71	1100	23	1015	37	8
Oneof1stQtzArenites_72	2004	54	1329	76	34
Oneof1stQtzArenites_73	683	18	465	18	32
Oneof1stQtzArenites_74	1626	61	1493	58	8
Oneof1stQtzArenites_75	2560	69	1144	61	55
Oneof1stQtzArenites_76	1588	41	1052	48	34
Oneof1stQtzArenites_77	4053	71	2770	170	32
Oneof1stQtzArenites_78	888	27	703	34	21
Oneof1stQtzArenites_79	1382	24	1394	38	1
Oneof1stQtzArenites_80	1069	18	996	28	7
Oneof1stQtzArenites_81	1677	51	1141	60	32
Oneof1stQtzArenites_82	1723	25	1731	55	0
Oneof1stQtzArenites_83	1062	25	861	38	19
Oneof1stQtzArenites_84	1353	28	1277	33	6
Oneof1stQtzArenites_85	1340	25	1337	42	0
Oneof1stQtzArenites_86	981	21	1000	32	2
Oneof1stQtzArenites_87	1508	41	1071	44	29
Oneof1stQtzArenites_88	1005	28	872	50	13
Oneof1stQtzArenites_89	1355	21	1293	38	5
Oneof1stQtzArenites_90	2782	94	1520	110	45
Oneof1stQtzArenites_91	1178	26	1191	52	1
Oneof1stQtzArenites_92	3436	59	2120	130	38
Oneof1stQtzArenites_93	1984	37	1165	31	41
Oneof1stQtzArenites_94	3741	45	2480	110	34

Oneof1stQtzArenites_95	1320	40	1108	52	16
Oneof1stQtzArenites_96	4090	100	3000	220	27
Oneof1stQtzArenites_97	1343	30	1247	44	7
Oneof1stQtzArenites_98	1078	22	1085	30	1
Oneof1stQtzArenites_99	1149	20	1132	29	1
Oneof1stQtzArenites_100	1265	46	1041	56	18
Oneof1stQtzArenites_101	1358	24	1381	33	2
Oneof1stQtzArenites_102	1197	26	1210	32	1
Oneof1stQtzArenites_103	1134	26	885	37	22
Oneof1stQtzArenites_104	1446	28	1421	41	2
Oneof1stQtzArenites_105	1165	26	1169	37	0
Oneof1stQtzArenites_106	1875	40	1177	47	37
Oneof1stQtzArenites_107	1270	26	1268	39	0
Oneof1stQtzArenites_108	1549	30	1553	55	0
Oneof1stQtzArenites_109	922	30	647	34	30
Oneof1stQtzArenites_110	2034	61	1101	59	46
Oneof1stQtzArenites_111	1263	27	1270	43	1
Oneof1stQtzArenites_112	1780	34	1030	41	42
Oneof1stQtzArenites_113	1053	31	1061	42	1
Oneof1stQtzArenites_114	1216	39	1234	59	1
Oneof1stQtzArenites_115	838	30	747	36	11
Oneof1stQtzArenites_116	1175	24	1194	35	2
Oneof1stQtzArenites_117	1134	38	913	42	19
Oneof1stQtzArenites_118	1156	26	1139	38	1
Oneof1stQtzArenites_119	550	19	553	21	1
Oneof1stQtzArenites_120	1084	25	1076	34	1
Oneof1stQtzArenites_121	1065	25	1068	37	0
Oneof1stQtzArenites_122	1466	29	1440	51	2
Oneof1stQtzArenites_123	1183	28	1167	42	1
Oneof1stQtzArenites_124	1186	30	1156	40	3
Oneof1stQtzArenites_125	1010	24	1005	30	0
Oneof1stQtzArenites_126	973	19	893	28	8
Oneof1stQtzArenites_127	1134	21	1089	24	4
Oneof1stQtzArenites_128	1388	26	1381	31	1
Oneof1stQtzArenites_129	1482	23	1485	34	0
Oneof1stQtzArenites_130	1091	21	1065	35	2
Oneof1stQtzArenites_131	2510	210	1640	140	35
Oneof1stQtzArenites_132	3770	100	2600	220	31
Oneof1stQtzArenites_133	1517	26	1522	42	0
Oneof1stQtzArenites_134	1151	23	1019	32	11
Oneof1stQtzArenites_135	1536	31	1482	54	4
Oneof1stQtzArenites_136	992	25	527	26	47
Oneof1stQtzArenites_137	1285	28	1157	40	10
Oneof1stQtzArenites_138	1390	24	1259	36	9

Oneof1stQtzArenites_139	5316	72	6550	330	23
Oneof1stQtzArenites_140	1207	24	1233	39	2
Oneof1stQtzArenites_141	1247	29	1168	42	6
Oneof1stQtzArenites_142	1294	30	1262	52	2
Oneof1stQtzArenites_143	1402	26	1408	45	0
Oneof1stQtzArenites_144	2538	61	1371	86	46
Oneof1stQtzArenites_145	1274	28	1207	56	5
Oneof1stQtzArenites_146	1428	31	1340	55	6
Oneof1stQtzArenites_147	1532	26	1540	42	1
Oneof1stQtzArenites_148	1383	24	1435	53	4
Oneof1stQtzArenites_149	960	28	837	42	13
Oneof1stQtzArenites_150	1358	56	1130	77	17
Oneof1stQtzArenites_151	1475	29	1451	52	2
Oneof1stQtzArenites_152	1417	32	1395	46	2
Oneof1stQtzArenites_153	1255	33	1126	50	10
Oneof1stQtzArenites_154	1376	25	1318	40	4
Oneof1stQtzArenites_155	1009	21	1016	32	1
Oneof1stQtzArenites_156	1940	63	1067	70	45
Oneof1stQtzArenites_157	787	31	476	29	40
Oneof1stQtzArenites_158	1065	18	1070	27	0
Oneof1stQtzArenites_159	1575	38	1499	59	5
Oneof1stQtzArenites_160	1138	27	1090	42	4
Oneof1stQtzArenites_161	583	24	558	30	4
Oneof1stQtzArenites_162	1162	21	1143	26	2
Oneof1stQtzArenites_163	1163	27	1168	38	0
Oneof1stQtzArenites_164	1381	38	1337	63	3
Oneof1stQtzArenites_165	1279	32	1223	45	4
Oneof1stQtzArenites_166	1214	26	1132	46	7
Oneof1stQtzArenites_167	766	26	508	27	34
Oneof1stQtzArenites_168	1252	68	1140	110	9
Oneof1stQtzArenites_169	1152	24	1129	37	2
Oneof1stQtzArenites_170	1382	34	1358	58	2
Oneof1stQtzArenites_171	1062	27	998	44	6
Oneof1stQtzArenites_172	1110	29	1098	43	1
Oneof1stQtzArenites_173	1193	27	1175	42	2
Oneof1stQtzArenites_174	1204	29	1161	50	4
Oneof1stQtzArenites_175	1233	37	1247	46	1
Oneof1stQtzArenites_176	1030	69	821	78	20
Oneof1stQtzArenites_177	1485	26	1462	53	2
Oneof1stQtzArenites_178	1063	23	1037	31	2
Oneof1stQtzArenites_179	1039	23	1058	44	2
Oneof1stQtzArenites_180	1124	20	1140	39	1
Oneof1stQtzArenites_181	1130	20	1028	30	9
Oneof1stQtzArenites_182	1173	24	1154	43	2

Oneof1stQtzArenites_183	1201	29	1216	47	1
Oneof1stQtzArenites_184	1594	66	1435	41	10
Plug 7-Bed 59 (1st Run)					
OneBelow63_1	1433	37	1442	63	1
OneBelow63_2	1094	17	1083	23	1
OneBelow63_3	935	23	838	35	10
OneBelow63_4	1162	14	1182	25	2
OneBelow63_5	1269	16	1266	27	0
OneBelow63_6	1469	19	1492	40	2
OneBelow63_7	1414	15	1432	28	1
OneBelow63_8	1041	15	1040	26	0
OneBelow63_9	1405	26	1414	48	1
OneBelow63_10	1145	24	1149	46	0
OneBelow63_11	1186	22	1197	40	1
OneBelow63_12	1359	22	1298	39	4
OneBelow63_13	1325	20	1331	37	0
OneBelow63_14	1454	26	1442	44	1
OneBelow63_15	1242	21	1232	38	1
OneBelow63_16	1363	32	1172	33	14
OneBelow63_17	1160	19	1052	29	9
OneBelow63_18	1492	22	1522	44	2
OneBelow63_19	1399	20	1410	46	1
OneBelow63_20	1443	24	1462	49	1
OneBelow63_21	1167	25	1162	45	0
OneBelow63_22	826	22	662	31	20
OneBelow63_23	1141	16	1155	26	1
OneBelow63_24	1177	16	1174	28	0
OneBelow63_25	1225	17	1244	32	2
OneBelow63_26	1167	49	1106	39	5
OneBelow63_27	1023	17	1024	27	0
OneBelow63_28	1040	19	1048	27	1
OneBelow63_29	1339	25	1355	49	1
OneBelow63_30	1017	22	1023	31	1
OneBelow63_31	1297	25	1278	50	1
OneBelow63_32	1282	17	1276	37	0
OneBelow63_33	1105	20	1097	34	1
OneBelow63_34	1465	23	1482	44	1
OneBelow63_35	1572	22	1571	45	0
OneBelow63_36	1013	20	1022	35	1
OneBelow63_37	1120	19	1068	34	5
OneBelow63_38	1152	20	1156	33	0
OneBelow63_39	1072	17	976	35	9
OneBelow63_40	1189	18	1196	25	1
OneBelow63_41	1185	20	1201	31	1

OneBelow63_42	1372	21	1406	38	2
OneBelow63_43	1177	16	1181	27	0
OneBelow63_44	1206	18	1214	30	1
OneBelow63_45	1466	19	1471	33	0
OneBelow63_46	1214	19	1184	33	2
OneBelow63_47	1197	28	1215	41	2
OneBelow63_48	1338	20	1333	36	0
OneBelow63_49	1476	19	1513	32	3
OneBelow63_50	1407	20	1421	33	1
OneBelow63_51	1293	40	1062	54	18
OneBelow63_52	1461	22	1474	33	1
OneBelow63_53	641	22	487	26	24
OneBelow63_54	1035	20	949	28	8
OneBelow63_55	1273	24	1284	47	1
OneBelow63_56	1422	20	1410	36	1
OneBelow63_57	1302	23	1324	40	2
OneBelow63_58	1203	23	1215	44	1
OneBelow63_59	1395	24	1383	47	1
OneBelow63_60	1129	31	996	45	12
OneBelow63_61	1277	26	1288	51	1
OneBelow63_62	1093	23	1096	38	0
OneBelow63_63	1026	22	1036	33	1
OneBelow63_64	1426	25	1145	35	20
OneBelow63_65	1096	18	1085	33	1
OneBelow63_66	1189	20	1211	38	2
OneBelow63_67	1252	20	1278	35	2
OneBelow63_68	1641	23	1610	47	2
OneBelow63_69	1052	17	1058	34	1
OneBelow63_70	1178	22	1187	39	1
OneBelow63_71	1172	25	1120	49	4
OneBelow63_72	978	24	934	39	4
OneBelow63_73	989	18	858	26	13
OneBelow63_74	1280	21	1284	39	0
OneBelow63_75	922	19	810	29	12
OneBelow63_76	1448	25	1389	43	4
OneBelow63_77	1325	25	1316	44	1
OneBelow63_78	1456	22	1454	44	0
OneBelow63_79	1464	26	1467	55	0
OneBelow63_80	1410	27	1430	53	1
OneBelow63_81	1502	29	1534	55	2
OneBelow63_82	1126	19	1148	29	2
OneBelow63_83	1537	33	1491	58	3
OneBelow63_84	1143	23	1160	44	1
OneBelow63_85	1396	20	1407	42	1

OneBelow63_86	1241	41	1167	61	6
OneBelow63_87	1452	29	1342	45	8
OneBelow63_88	1135	57	948	79	16
OneBelow63_89	1073	24	1047	43	2
OneBelow63_90	1114	22	1113	38	0
OneBelow63_91	1672	49	1557	48	7
OneBelow63_92	1060	24	1087	33	3
OneBelow63_93	1477	22	1522	37	3
OneBelow63_94	852	20	696	30	18
OneBelow63_95	1130	21	1156	41	2
OneBelow63_96	1140	20	1096	39	4
OneBelow63_97	1086	29	1031	49	5
OneBelow63_98	3035	47	2830	110	7
OneBelow63_99	1317	20	1261	30	4
OneBelow63_100	1449	26	1440	55	1
Plug 7-Bed 59 (2nd Run)					
OneBelow63_1	1270	21	1285	39	1
OneBelow63_2	1057	19	866	30	18
OneBelow63_3	1211	19	1190	34	2
OneBelow63_4	1077	22	1064	42	1
OneBelow63_5	1232	23	1242	38	1
OneBelow63_6	1189	27	1197	52	1
OneBelow63_7	1271	24	1284	47	1
OneBelow63_8	1662	29	1673	60	1
OneBelow63_9	1019	19	960	31	6
OneBelow63_10	1345	25	1292	48	4
OneBelow63_11	1108	22	1105	37	0
OneBelow63_12	2637	25	2556	71	3
OneBelow63_13	1113	22	1129	38	1
OneBelow63_14	1041	24	980	40	6
OneBelow63_15	1198	30	1156	41	4
OneBelow63_16	1178	23	1179	37	0
OneBelow63_17	1184	25	1206	44	2
OneBelow63_18	1404	26	1406	49	0
OneBelow63_19	864	33	588	38	32
OneBelow63_20	1024	20	956	36	7
OneBelow63_21	1176	21	1178	33	0
OneBelow63_22	1136	23	1162	40	2
OneBelow63_23	1254	25	1269	43	1
OneBelow63_24	1582	25	1617	57	2
OneBelow63_25	1114	23	1074	36	4
OneBelow63_26	1463	29	1438	44	2
OneBelow63_27	1599	29	1598	58	0
OneBelow63_28	1435	26	1297	38	10

OneBelow63_29	1075	21	1058	36	2
OneBelow63_30	1114	28	1124	54	1
OneBelow63_31	1255	26	1191	45	5
OneBelow63_32	2621	28	2543	73	3
OneBelow63_33	1513	48	1354	72	11
OneBelow63_34	1207	30	1171	48	3
OneBelow63_35	1222	25	1187	48	3
OneBelow63_36	1109	33	996	41	10
OneBelow63_37	1499	27	1536	54	2
OneBelow63_38	1154	27	1159	45	0
OneBelow63_39	1178	26	1148	47	3
OneBelow63_40	643	15	430	16	33
OneBelow63_41	1177	27	1205	31	2
OneBelow63_42	744	20	455	19	39
OneBelow63_43	1213	23	1205	38	1
OneBelow63_44	1463	22	1497	43	2
OneBelow63_45	1456	24	1462	52	0
OneBelow63_46	1482	27	1491	52	1
OneBelow63_47	1493	30	1370	51	8
OneBelow63_48	1622	43	1576	64	3
OneBelow63_49	1123	26	1139	47	1
OneBelow63_50	1383	24	1362	41	2
OneBelow63_51	1410	28	1420	52	1
OneBelow63_52	1172	28	1174	44	0
OneBelow63_53	1132	22	1108	37	2
OneBelow63_54	999	24	1005	39	1
OneBelow63_55	930	19	841	29	10
OneBelow63_56	952	17	694	22	27
OneBelow63_57	1062	23	964	37	9
OneBelow63_58	1134	25	1063	44	6
OneBelow63_59	1178	24	1193	44	1
OneBelow63_60	1451	28	1448	55	0
OneBelow63_61	1068	23	1036	38	3
OneBelow63_62	1382	24	1382	42	0
OneBelow63_63	1223	28	1225	50	0
OneBelow63_64	1295	36	1294	59	0
OneBelow63_65	1165	29	1148	47	1
OneBelow63_66	884	21	586	22	34
OneBelow63_67	1286	20	1256	36	2
OneBelow63_68	1370	34	1400	60	2
OneBelow63_69	1230	34	1230	60	0
OneBelow63_70	1082	27	1085	36	0
OneBelow63_71	1273	17	1256	33	1
OneBelow63_72	1133	19	1143	31	1

OneBelow63_73	1416	21	1431	41	1
OneBelow63_74	1446	26	1444	41	0
OneBelow63_75	1324	22	1326	35	0
OneBelow63_76	1354	28	1301	47	4
OneBelow63_77	1461	23	1474	41	1
OneBelow63_78	1339	23	1368	43	2
OneBelow63_79	2324	85	1890	120	19
OneBelow63_80	1501	22	1524	37	2
OneBelow63_81	1365	18	1359	30	0
OneBelow63_82	859	16	772	22	10
OneBelow63_83	1645	14	1584	31	4
OneBelow63_84	1111	22	1109	27	0
OneBelow63_85	1177	19	1183	31	1
OneBelow63_86	1180	22	1211	41	3
OneBelow63_87	1369	31	1297	55	5
OneBelow63_88	1482	30	1495	54	1
OneBelow63_89	1064	20	1015	32	5
OneBelow63_90	1649	30	1642	56	0
OneBelow63_91	1271	54	1260	65	1
OneBelow63_92	1097	24	1110	38	1
OneBelow63_93	1356	22	1364	40	1
OneBelow63_94	1644	27	1673	45	2
OneBelow63_95	1383	18	1402	30	1
OneBelow63_96	1757	25	1796	59	2
OneBelow63_97	1723	31	1727	42	0
OneBelow63_98	1453	18	1460	26	0
OneBelow63_99	1348	31	1353	49	0
OneBelow63_100	1275	16	1290	29	1
Plug 2-Bed 76					
Dotson_1	1334	15	1265	17	5
Dotson_2	1213	14	1208	18	0
Dotson_3	1200	11	1190	16	1
Dotson_4	1059	9	1041	10	2
Dotson_5	1043	9	1023	10	2
Dotson_6	1594	25	1376	19	14
Dotson_7	1565	12	1431	13	9
Dotson_8	1623	23	1192	24	27
Dotson_9	1021	10	996	12	2
Dotson_10	1269	14	1061	12	16
Dotson_11	1353	10	1326	17	2
Dotson_12	1485	10	1464	15	1
Dotson_13	1248	14	1152	14	8
Dotson_14	1123	9	1086	13	3
Dotson_15	1264	17	1220	17	3

Dotson_16	1987	20	1918	27	3
Dotson_17	1190	24	1085	18	9
Dotson_18	1338	16	1269	16	5
Dotson_19	1261	10	1226	13	3
Dotson_20	1271	13	1221	15	4
Dotson_21	1152	10	719	10	38
Dotson_22	1155	11	1147	14	1
Dotson_23	1269	13	1191	15	6
Dotson_24	1144	10	1140	14	0
Dotson_25	1275	8	1249	13	2
Dotson_26	1164	14	1139	17	2
Dotson_27	1289	11	1270	16	1
Dotson_28	1324	14	1313	18	1
Dotson_29	1404	10	952	13	32
Dotson_30	1476	10	1462	15	1
Dotson_31	1243	11	1201	17	3
Dotson_32	1167	9	859	10	26
Dotson_33	1134	8	1037	23	9
Dotson_34	1002	12	676	13	33
Dotson_35	1231	13	1131	19	8
Dotson_36	1090	13	1095	15	0
Dotson_37	1114	12	1107	13	1
Dotson_38	1350	13	735	16	46
Dotson_39	987	11	553	9	44
Dotson_40	890	9	673	11	24
Dotson_41	1106	18	1055	16	5
Dotson_42	1118	14	1102	14	1
Dotson_43	1644	29	1195	17	27
Dotson_44	1145	17	1132	17	1
Dotson_45	1042	13	1051	16	1
Dotson_46	1072	14	1036	17	3
Dotson_47	1185	14	281	7	76
Dotson_48	1061	12	1033	15	3
Dotson_49	852	11	436	7	49
Dotson_50	1255	15	1189	23	5
Dotson_51	1164	18	1182	19	2
Dotson_52	1171	16	1180	20	1
Dotson_53	1402	15	1394	20	1
Dotson_54	1284	18	1271	22	1
Dotson_55	1328	11	1340	15	1
Dotson_56	1307	11	1309	17	0
Dotson_57	1408	13	1398	22	1
Dotson_58	1465	13	1477	19	1
Dotson_59	1030	13	1007	15	2

Dotson_60	929	9	564	9	39
Dotson_61	1169	15	1162	18	1
Dotson_62	1151	13	1146	14	0
Dotson_63	665	36	71	5	89
Dotson_64	1200	9	476	8	60
Dotson_65	1141	40	900	27	21
Dotson_66	1134	29	980	40	14
Dotson_67	1065	10	678	9	36
Dotson_68	1477	11	438	7	70
Dotson_69	1525	12	465	6	70
Dotson_70	1276	13	1272	24	0
Dotson_71	1314	11	1254	12	5
Dotson_72	3333	38	1891	53	43
Dotson_73	3460	220	1840	300	47
Dotson_74	1113	12	1088	13	2
Dotson_75	1178	11	1172	15	1
Dotson_76	1172	10	1170	14	0
Plug 8-Bed 76					
DotsonMtn_1	1156	30	1179	47	2
DotsonMtn_2	1203	35	1164	55	3
DotsonMtn_3	1245	25	1272	39	2
DotsonMtn_4	1057	23	1078	39	2
DotsonMtn_5	846	27	466	25	45
DotsonMtn_6	1254	35	1250	48	0
DotsonMtn_7	1282	22	1212	35	5
DotsonMtn_8	1292	25	1273	37	1
DotsonMtn_9	1526	32	1419	43	7
DotsonMtn_10	1085	19	1091	28	1
DotsonMtn_11	1400	28	1407	47	0
DotsonMtn_12	1384	26	1396	54	1
DotsonMtn_13	1056	19	1092	36	3
DotsonMtn_14	1440	20	1481	41	3
DotsonMtn_15	1209	32	758	38	37
DotsonMtn_16	1110	28	1104	38	1
DotsonMtn_17	1387	18	1407	30	1
DotsonMtn_18	1443	21	1289	40	11
DotsonMtn_19	1054	18	1084	27	3
DotsonMtn_20	1028	20	1047	32	2
DotsonMtn_21	1189	22	1143	34	4
DotsonMtn_22	1172	27	1205	46	3
DotsonMtn_23	1369	30	1343	50	2
DotsonMtn_24	1087	27	1092	33	0
DotsonMtn_25	1471	24	1518	42	3
DotsonMtn_26	1411	30	1440	42	2

DotsonMtn_27	820	28	329	18	60
DotsonMtn_28	1358	23	1138	33	16
DotsonMtn_29	1076	22	1103	38	3
DotsonMtn_30	1065	20	1081	35	2
DotsonMtn_31	1053	24	1044	33	1
DotsonMtn_32	1218	21	1216	34	0
DotsonMtn_33	1053	18	1047	31	1
DotsonMtn_34	1102	29	1119	46	2
DotsonMtn_35	1396	35	1381	57	1
DotsonMtn_36	1199	26	1202	37	0
DotsonMtn_37	1152	20	1185	33	3
DotsonMtn_38	1179	25	1207	44	2
DotsonMtn_39	1118	22	1116	36	0
DotsonMtn_40	1304	27	985	45	24
DotsonMtn_41	1190	34	1220	59	3
DotsonMtn_42	1460	32	1502	64	3
DotsonMtn_43	1065	27	1083	46	2
DotsonMtn_44	2042	43	2042	79	0
DotsonMtn_45	1186	25	1150	40	3
DotsonMtn_46	1207	27	1223	53	1
DotsonMtn_47	1187	31	1204	45	1
DotsonMtn_48	1005	31	1002	45	0
DotsonMtn_49	1339	22	1360	48	2
DotsonMtn_50	1147	28	1152	46	0
DotsonMtn_51	1476	35	1468	63	1
DotsonMtn_52	1146	28	1167	56	2
DotsonMtn_53	1482	33	1448	67	2
DotsonMtn_54	1165	28	1117	46	4
DotsonMtn_55	1163	28	1163	52	0
DotsonMtn_56	1418	27	1400	48	1
DotsonMtn_57	1042	27	1025	42	2
DotsonMtn_58	1218	29	1208	43	1
DotsonMtn_59	1471	25	1487	57	1
DotsonMtn_60	1080	31	1074	57	1
DotsonMtn_61	1321	37	1356	66	3
DotsonMtn_62	1114	25	1126	44	1
DotsonMtn_63	1709	34	1619	67	5
DotsonMtn_64	1272	35	1221	63	4
DotsonMtn_65	1257	32	1280	56	2
DotsonMtn_66	1110	25	1106	41	0
DotsonMtn_67	1066	29	1080	49	1
DotsonMtn_68	1170	35	1167	56	0
DotsonMtn_69	1380	36	1372	69	1
DotsonMtn_70	1140	30	1139	55	0

DotsonMtn_71	1146	25	1168	55	2
DotsonMtn_72	1099	25	1088	44	1
DotsonMtn_73	1028	22	1021	39	1
DotsonMtn_74	1052	25	1087	44	3
DotsonMtn_75	1188	26	1242	47	5
DotsonMtn_76	1110	30	1125	50	1
DotsonMtn_77	1310	36	1306	65	0
DotsonMtn_78	1321	33	1357	62	3
DotsonMtn_79	1488	30	1509	54	1
DotsonMtn_80	1201	32	1217	55	1
DotsonMtn_81	1129	32	1141	53	1
DotsonMtn_82	1342	28	1343	50	0
DotsonMtn_83	1074	26	1069	40	0
DotsonMtn_84	1172	29	1210	58	3
DotsonMtn_85	1055	29	1068	48	1
DotsonMtn_86	1446	28	1453	57	0
DotsonMtn_87	909	23	485	22	47
DotsonMtn_88	1163	30	1173	47	1
DotsonMtn_89	981	24	977	39	0
DotsonMtn_90	1188	28	1226	56	3
DotsonMtn_91	1434	35	1413	70	1
DotsonMtn_92	1172	27	1173	48	0
DotsonMtn_93	1082	28	1117	49	3
DotsonMtn_94	1153	35	1151	53	0
DotsonMtn_95	1103	30	1113	51	1
DotsonMtn_96	1006	24	1019	36	1
DotsonMtn_97	1202	27	1210	58	1
DotsonMtn_98	1315	41	1313	70	0
DotsonMtn_99	1237	29	946	40	24
DotsonMtn_100	1170	28	1192	49	2
DotsonMtn_101	1161	47	1035	46	11
DotsonMtn_102	991	27	1001	37	1
DotsonMtn_103	1472	28	1484	55	1
DotsonMtn_104	1266	31	1257	48	1
DotsonMtn_105	1371	45	1277	60	7
DotsonMtn_106	1030	22	1031	37	0
DotsonMtn_107	1204	35	1176	52	2
DotsonMtn_108	1099	27	1093	42	1
DotsonMtn_109	1197	24	1206	39	1
DotsonMtn_110	1085	26	1084	43	0
DotsonMtn_111	1357	27	1344	47	1
DotsonMtn_112	1153	25	1140	38	1
DotsonMtn_113	1074	28	1091	47	2
DotsonMtn_114	1255	42	1071	51	15

DotsonMtn_115	1034	30	1024	45	1
DotsonMtn_116	1053	23	1058	39	0
DotsonMtn_117	1162	28	1182	47	2
DotsonMtn_118	1250	31	1226	58	2
DotsonMtn_119	1370	26	1384	52	1
DotsonMtn_120	1383	24	1335	37	3
LA 20150810 Dotson (Mid SS)					
DotsonMtnSst_1	1135	21	1068	14	6
DotsonMtnSst_2	1074	15	581	10	46
DotsonMtnSst_3	1116	28	1106	16	1
DotsonMtnSst_4	1459	19	1431	18	2
DotsonMtnSst_5	588	14	537	7	9
DotsonMtnSst_6	1114	23	1101	17	1
DotsonMtnSst_7	1140	16	1105	15	3
DotsonMtnSst_8	1159	19	1163	16	0
DotsonMtnSst_9	1221	17	1207	15	1
DotsonMtnSst_10	1379	17	1336	17	3
DotsonMtnSst_11	1301	14	1241	15	5
DotsonMtnSst_12	1474	16	1435	18	3
DotsonMtnSst_13	1533	15	1421	18	7
DotsonMtnSst_14	1087	24	1051	15	3
DotsonMtnSst_15	898	41	879	19	2
DotsonMtnSst_16	1174	26	1141	16	3
DotsonMtnSst_17	1505	14	1500	18	0
DotsonMtnSst_18	1142	15	1119	15	2
DotsonMtnSst_19	1143	24	1077	17	6
DotsonMtnSst_20	1085	17	1090	14	0
DotsonMtnSst_21	1079	15	1060	13	2
DotsonMtnSst_22	1128	19	1095	14	3
DotsonMtnSst_23	1203	20	1187	19	1
DotsonMtnSst_24	1058	28	1013	17	4
DotsonMtnSst_25	1122	22	1105	16	2
DotsonMtnSst_26	1117	23	1059	16	5
DotsonMtnSst_27	1015	19	1020	14	0
DotsonMtnSst_28	1191	14	1159	13	3
DotsonMtnSst_29	1109	14	1067	13	4
DotsonMtnSst_30	1017	18	929	14	9
DotsonMtnSst_31	1192	12	1166	13	2
DotsonMtnSst_32	1075	14	1059	14	1
DotsonMtnSst_33	1196	14	1186	16	1
DotsonMtnSst_34	1169	13	1068	13	9
DotsonMtnSst_35	1289	15	643	11	50
DotsonMtnSst_36	1140	16	1122	15	2
DotsonMtnSst_37	1061	13	1057	12	0

DotsonMtnSst_38	1126	13	994	15	12
DotsonMtnSst_39	1125	21	1111	17	1
DotsonMtnSst_40	1204	21	1187	15	1
DotsonMtnSst_41	1250	17	839	18	33
DotsonMtnSst_42	1163	14	1166	14	0
DotsonMtnSst_43	1115	22	1042	13	7
DotsonMtnSst_44	1141	26	1104	18	3
DotsonMtnSst_45	1410	15	1300	16	8
DotsonMtnSst_46	1146	23	1133	15	1
DotsonMtnSst_47	1058	14	1052	14	1
DotsonMtnSst_48	1375	16	1287	20	6
DotsonMtnSst_49	1383	32	1204	27	13
DotsonMtnSst_50	1031	17	1036	13	0
DotsonMtnSst_51	1144	25	1088	17	5
DotsonMtnSst_52	982	16	964	13	2
DotsonMtnSst_53	1032	15	1021	11	1
DotsonMtnSst_54	1006	18	951	13	5
DotsonMtnSst_55	1246	19	1234	16	1
DotsonMtnSst_56	1199	19	1007	16	16
DotsonMtnSst_57	1142	24	1148	16	1
DotsonMtnSst_58	1434	23	1355	24	6
DotsonMtnSst_59	1012	20	1001	14	1
DotsonMtnSst_60	1136	18	1100	16	3
DotsonMtnSst_61	959	20	933	13	3
DotsonMtnSst_62	1105	15	1079	13	2
DotsonMtnSst_63	1165	15	1075	13	8
DotsonMtnSst_64	1102	12	976	9	11
DotsonMtnSst_65	1398	30	1307	20	7
DotsonMtnSst_66	1203	23	1164	16	3
DotsonMtnSst_67	1094	20	1073	14	2
DotsonMtnSst_68	1145	16	1120	17	2
DotsonMtnSst_69	1099	12	758	12	31
DotsonMtnSst_70	1043	16	986	13	5
DotsonMtnSst_71	1089	25	1072	16	2
DotsonMtnSst_72	1215	24	1066	18	12
DotsonMtnSst_73	1186	16	1157	15	2
DotsonMtnSst_74	1425	19	1385	20	3
DotsonMtnSst_75	1389	21	1347	19	3
DotsonMtnSst_76	1408	30	1349	23	4
DotsonMtnSst_77	1218	20	1211	19	1
DotsonMtnSst_78	1239	13	1213	14	2
DotsonMtnSst_79	1038	33	986	19	5
DotsonMtnSst_80	1476	15	1473	19	0
DotsonMtnSst_81	995	18	965	13	3

DotsonMtnSst_82	1440	17	1272	16	12
DotsonMtnSst_83	1036	22	1018	16	2
DotsonMtnSst_84	1163	24	1138	19	2
DotsonMtnSst_85	1118	34	965	18	14
DotsonMtnSst_86	1201	18	1165	14	3
DotsonMtnSst_87	1143	43	1025	23	10
DotsonMtnSst_88	1038	16	1005	13	3
DotsonMtnSst_89	1099	12	1048	14	5
DotsonMtnSst_90	1033	10	1024	13	1
DotsonMtnSst_91	1141	17	1142	16	0
DotsonMtnSst_92	1523	15	1353	16	11
DotsonMtnSst_93	1199	21	1142	14	5
DotsonMtnSst_94	967	18	951	12	2
DotsonMtnSst_95	1147	15	1144	13	0
DotsonMtnSst_96	1059	16	1060	14	0
DotsonMtnSst_97	1023	18	997	11	3
DotsonMtnSst_98	2694	14	2686	31	0
DotsonMtnSst_99	1158	19	1021	13	12
DotsonMtnSst_100	2875	41	1601	43	44
DotsonMtnSst_101	1176	39	1102	21	6
DotsonMtnSst_102	1500	16	1495	18	0
DotsonMtnSst_103	1120	16	1055	14	6
DotsonMtnSst_104	1167	11	844	10	28
DotsonMtnSst_105	1177	13	1163	13	1
DotsonMtnSst_106	1190	30	1092	18	8
DotsonMtnSst_107	1037	16	1032	13	0
DotsonMtnSst_108	2679	17	2564	29	4
DotsonMtnSst_109	1091	13	1084	12	1
DotsonMtnSst_110	1061	12	1031	12	3
DotsonMtnSst_111	1064	16	1056	12	1
DotsonMtnSst_112	1165	17	1125	14	3
DotsonMtnSst_113	1096	16	1086	13	1
DotsonMtnSst_114	1260	14	1243	14	1
DotsonMtnSst_115	938	9	391	10	58
DotsonMtnSst_116	1043	22	960	15	8
DotsonMtnSst_117	1078	30	1002	17	7
DotsonMtnSst_118	1303	17	1286	16	1
DotsonMtnSst_119	1045	19	1040	12	0
DotsonMtnSst_120	1071	16	946	14	12
DotsonMtnSst_121	1118	21	1099	15	2
DotsonMtnSst_122	1438	18	1389	17	3
DotsonMtnSst_123	1105	15	1090	14	1
DotsonMtnSst_124	1201	13	1166	13	3
DotsonMtnSst_125	1229	17	1201	16	2

Plug 7-Bed 78					
Dodson1stabvmidSS_1	1233	45	1252	69	2
Dodson1stabvmidSS_2	1043	58	1081	95	4
Dodson1stabvmidSS_3	1181	52	1056	68	11
Dodson1stabvmidSS_4	1095	51	1116	79	2
Dodson1stabvmidSS_5	1240	48	1313	94	6
Dodson1stabvmidSS_6	1258	57	1284	84	2
Dodson1stabvmidSS_7	1116	56	1145	68	3
Dodson1stabvmidSS_8	1445	44	1502	86	4
Dodson1stabvmidSS_9	1441	54	1596	91	11
Dodson1stabvmidSS_10	1027	49	1070	67	4
Dodson1stabvmidSS_11	1436	48	1441	72	0
Dodson1stabvmidSS_12	1049	45	1024	61	2
Dodson1stabvmidSS_13	1537	52	1565	89	2
Dodson1stabvmidSS_14	1459	51	1530	100	5
Dodson1stabvmidSS_15	790	39	596	36	25
Dodson1stabvmidSS_16	1161	37	1234	70	6
Dodson1stabvmidSS_17	1225	49	1189	78	3
Dodson1stabvmidSS_18	1282	53	1304	79	2
Dodson1stabvmidSS_19	1053	39	1018	59	3
Dodson1stabvmidSS_20	1063	60	1084	84	2
Dodson1stabvmidSS_21	1001	68	984	85	2
Dodson1stabvmidSS_22	1231	48	1248	84	1
Dodson1stabvmidSS_23	1172	51	1181	56	1
Dodson1stabvmidSS_24	1124	39	1156	66	3
Dodson1stabvmidSS_25	1473	52	1488	90	1
Dodson1stabvmidSS_26	1198	58	1071	56	11
Dodson1stabvmidSS_27	1120	41	1154	72	3
Dodson1stabvmidSS_28	969	38	919	57	5
Dodson1stabvmidSS_29	1180	40	1040	59	12
Dodson1stabvmidSS_30	1073	39	1044	46	3
Dodson1stabvmidSS_31	1221	48	1229	81	1
Dodson1stabvmidSS_32	1297	57	1249	87	4
Dodson1stabvmidSS_33	1435	55	1404	77	2
Dodson1stabvmidSS_34	1141	51	1177	85	3
Dodson1stabvmidSS_35	974	38	956	53	2
Dodson1stabvmidSS_36	1028	54	1097	71	7
Dodson1stabvmidSS_37	1065	38	1068	58	0
Dodson1stabvmidSS_38	1072	50	1066	65	1
Dodson1stabvmidSS_39	1205	45	1181	60	2
Dodson1stabvmidSS_40	1224	58	1248	78	2
Dodson1stabvmidSS_41	1397	58	1431	98	2
Dodson1stabvmidSS_42	1196	86	1157	89	3
Dodson1stabvmidSS_43	1000	46	974	75	3

Dodson1stabvmidSS_44	1363	59	1430	120	5
Dodson1stabvmidSS_45	1115	84	1065	85	4
Dodson1stabvmidSS_46	1409	64	1380	120	2
Dodson1stabvmidSS_47	1256	77	1034	78	18
Dodson1stabvmidSS_48	1179	66	1130	78	4
Dodson1stabvmidSS_49	910	45	803	62	12
Dodson1stabvmidSS_50	464	29	448	34	3
Dodson1stabvmidSS_51	1434	51	1427	91	0
Dodson1stabvmidSS_52	1416	43	1494	69	6
Dodson1stabvmidSS_53	1291	65	1276	87	1
Dodson1stabvmidSS_54	1057	40	1027	63	3
Dodson1stabvmidSS_55	1223	45	1255	66	3
Dodson1stabvmidSS_56	1069	36	1102	52	3
Dodson1stabvmidSS_57	1506	55	1054	57	30
Dodson1stabvmidSS_58	983	49	857	52	13
Dodson1stabvmidSS_59	1216	47	1286	63	6
Dodson1stabvmidSS_60	1244	57	1247	73	0
Dodson1stabvmidSS_61	1269	70	1190	81	6
Dodson1stabvmidSS_62	1337	67	1380	100	3
Dodson1stabvmidSS_63	1441	58	1540	100	7
Dodson1stabvmidSS_64	1454	78	1360	100	6
Dodson1stabvmidSS_65	1334	54	1330	110	0
Dodson1stabvmidSS_66	948	62	999	80	5
Dodson1stabvmidSS_67	1153	71	1115	77	3
Dodson1stabvmidSS_68	1132	54	1099	76	3
Dodson1stabvmidSS_69	1234	44	1193	62	3
Dodson1stabvmidSS_70	1156	43	1193	75	3
Dodson1stabvmidSS_71	673	30	480	26	29
Dodson1stabvmidSS_72	1486	38	1497	58	1
Dodson1stabvmidSS_73	1670	47	1675	86	0
Dodson1stabvmidSS_74	1475	47	1449	69	2
Dodson1stabvmidSS_75	1239	48	1105	63	11
Dodson1stabvmidSS_76	1166	39	1199	62	3
Dodson1stabvmidSS_77	1216	42	1233	73	1
Dodson1stabvmidSS_78	1330	45	1305	69	2
Dodson1stabvmidSS_79	967	31	980	51	1
Dodson1stabvmidSS_80	1036	43	1081	66	4
Dodson1stabvmidSS_81	1235	45	1225	72	1
Dodson1stabvmidSS_82	1073	61	1027	69	4
Dodson1stabvmidSS_83	1140	55	1100	71	4
Dodson1stabvmidSS_84	1288	37	1272	57	1
Dodson1stabvmidSS_85	1300	42	1301	57	0
Dodson1stabvmidSS_86	1122	32	1150	46	2
Dodson1stabvmidSS_87	1567	53	1600	100	2

Dodson1stabvmidSS_88	1426	51	1508	91	6
Dodson1stabvmidSS_89	1006	45	975	60	3
Dodson1stabvmidSS_90	1352	48	1257	69	7
Dodson1stabvmidSS_91	1076	50	1100	65	2
Dodson1stabvmidSS_92	1445	43	1399	62	3
Dodson1stabvmidSS_93	1406	46	1365	86	3
Dodson1stabvmidSS_94	4060	370	3720	680	8
Dodson1stabvmidSS_95	2710	160	2260	250	17
Dodson1stabvmidSS_96	1255	55	1243	69	1
Dodson1stabvmidSS_97	1117	48	1118	67	0
Dodson1stabvmidSS_98	1370	54	1347	81	2
Dodson1stabvmidSS_99	1434	45	1356	76	5
Dodson1stabvmidSS_100	1350	120	1085	94	20
Dodson1stabvmidSS_101	1599	70	1540	100	4
Dodson1stabvmidSS_102	1145	41	1095	54	4
Dodson1stabvmidSS_103	1276	58	1333	83	4
Dodson1stabvmidSS_104	1157	58	1176	79	2
Dodson1stabvmidSS_105	1105	60	1119	74	1
Dodson1stabvmidSS_106	1234	41	1235	68	0
Plug 6-Bed 93 (1st Run)					
Dodson855_1	1406	21	1388	38	1
Dodson855_2	1786	32	1469	37	18
Dodson855_3	1185	23	1161	44	2
Dodson855_4	1208	20	1038	28	14
Dodson855_5	1383	22	1217	41	12
Dodson855_6	1065	23	1032	27	3
Dodson855_7	1443	24	1328	36	8
Dodson855_8	1064	28	1062	31	0
Dodson855_9	1235	20	1209	32	2
Dodson855_10	1217	25	1245	36	2
Dodson855_11	997	20	986	28	1
Dodson855_12	993	20	1000	31	1
Dodson855_13	1251	65	1022	35	18
Dodson855_14	1378	22	1341	38	3
Dodson855_15	1201	28	1202	39	0
Dodson855_16	1251	29	873	33	30
Dodson855_17	1044	26	1037	30	1
Dodson855_18	1380	26	1332	40	3
Dodson855_19	1200	26	1140	30	5
Dodson855_20	1444	27	887	42	39
Dodson855_21	1256	14	1252	21	0
Dodson855_22	1195	16	1011	36	15
Dodson855_23	1042	14	1034	17	1
Dodson855_24	1318	18	1092	25	17

Dodson855_25	1236	20	1143	25	8
Dodson855_26	1175	17	1183	24	1
Dodson855_27	1110	12	1092	18	2
Dodson855_28	1137	16	1130	21	1
Dodson855_29	1377	21	672	21	51
Dodson855_30	1048	21	966	31	8
Dodson855_31	1051	20	1002	23	5
Dodson855_32	1464	19	1496	31	2
Dodson855_33	1120	23	1056	23	6
Dodson855_34	1451	27	709	20	51
Dodson855_35	1509	15	1399	28	7
Dodson855_36	1242	24	808	28	35
Dodson855_37	1143	19	1008	29	12
Dodson855_38	1344	18	1306	32	3
Dodson855_39	1417	17	1372	32	3
Dodson855_40	1618	21	1508	42	7
Dodson855_41	1008	21	1015	32	1
Dodson855_42	1392	23	1386	39	0
Dodson855_43	1888	21	1770	41	6
Dodson855_44	1339	20	1167	28	13
Dodson855_45	1471	32	1119	35	24
Dodson855_46	1000	23	995	25	1
Dodson855_47	1157	43	1021	29	12
Dodson855_48	1390	20	1061	34	24
Dodson855_49	1426	22	1404	31	2
Dodson855_50	1192	20	1187	31	0
Dodson855_51	1328	30	1050	35	21
Dodson855_52	1314	28	733	30	44
Dodson855_53	1245	30	1109	28	11
Dodson855_54	1160	20	1147	31	1
Dodson855_55	1356	20	1330	33	2
Dodson855_56	1068	28	995	31	7
Dodson855_57	1354	27	1354	39	0
Dodson855_58	1608	20	1573	40	2
Dodson855_59	1443	18	1437	28	0
Dodson855_60	1761	25	871	31	51
Dodson855_61	1102	17	1092	26	1
Dodson855_62	1077	20	1059	30	2
Dodson855_63	1919	40	1588	49	17
Dodson855_64	1282	20	1088	29	15
Dodson855_65	1479	21	1013	29	32
Dodson855_66	1441	22	1421	39	1
Dodson855_67	1204	20	1206	33	0
Dodson855_68	1469	19	1222	33	17

Dodson855_69	1467	22	1408	38	4
Dodson855_70	1502	23	1420	32	5
Dodson855_71	1516	24	1493	45	2
Dodson855_72	1333	21	1267	32	5
Dodson855_73	1010	29	1002	24	1
Dodson855_74	1086	23	1048	28	3
Dodson855_75	1806	21	1809	34	0
Dodson855_76	1418	22	1404	31	1
Dodson855_77	1266	23	223	9	82
Dodson855_78	1095	26	1069	23	2
Dodson855_79	1447	22	1443	38	0
Dodson855_80	1236	22	368	13	70
Dodson855_81	1460	17	1438	29	2
Dodson855_82	1389	18	1282	30	8
Dodson855_83	1138	22	1110	30	2
Dodson855_84	1315	18	1025	26	22
Dodson855_85	1624	19	1426	33	12
Dodson855_86	1193	17	1217	27	2
Dodson855_87	1039	17	959	20	8
Dodson855_88	1448	16	1437	26	1
Dodson855_89	1381	29	1327	33	4
Dodson855_90	1018	15	1028	22	1
Dodson855_91	1328	52	1054	24	21
Dodson855_92	1348	21	1223	39	9
Dodson855_93	1077	17	1065	27	1
Dodson855_94	1481	19	488	16	67
Dodson855_95	1022	15	993	19	3
Dodson855_96	1147	20	1149	30	0
Dodson855_97	1549	48	1200	21	23
Plug 6-Bed 93 (2nd Run)					
Dodson855_1	1000	17	939	26	6
Dodson855_2	1141	20	1135	34	1
Dodson855_3	1980	34	1514	45	24
Dodson855_4	1450	22	1446	42	0
Dodson855_5	1415	21	1417	41	0
Dodson855_6	1405	24	1412	43	0
Dodson855_7	1171	22	1180	37	1
Dodson855_8	1142	20	1147	35	0
Dodson855_9	1851	25	1818	53	2
Dodson855_10	980	31	378	23	61
Dodson855_11	1166	21	1159	41	1
Dodson855_12	1450	25	1442	45	1
Dodson855_13	1596	33	1343	46	16
Dodson855_14	1073	22	1096	40	2

Dodson855_15	1381	33	1368	60	1
Dodson855_16	1318	28	1342	55	2
Dodson855_17	1059	28	1002	37	5
Dodson855_18	1399	25	1215	44	13
Dodson855_19	1446	32	360	17	75
Dodson855_20	1199	22	1208	38	1
Dodson855_21	1443	31	591	32	59
Dodson855_22	1162	21	1134	33	2
Dodson855_23	1134	42	808	41	29
Dodson855_24	1337	20	1292	37	3
Dodson855_25	1476	86	1277	47	13
Dodson855_26	638	25	561	20	12
Dodson855_27	1177	26	1163	42	1
Dodson855_28	1215	29	1169	45	4
Dodson855_29	1438	27	1408	46	2
Dodson855_30	1493	28	1501	54	1
Dodson855_31	1147	28	1068	39	7
Dodson855_32	1183	20	1173	35	1
Dodson855_33	1577	30	1161	43	26
Dodson855_34	1426	24	1401	46	2
Dodson855_35	1403	25	1334	48	5
Dodson855_36	1502	21	1505	45	0
Dodson855_37	1067	21	1073	35	1
Dodson855_38	1407	21	1386	35	1
Dodson855_39	1436	26	1369	46	5
Dodson855_40	1377	24	1366	44	1
Dodson855_41	1011	18	942	29	7
Dodson855_42	1128	23	1147	38	2
Dodson855_43	1516	23	1423	46	6
Dodson855_44	1359	27	1233	47	9
Dodson855_45	1479	29	627	28	58
Dodson855_46	1225	28	334	20	73
Dodson855_47	1545	41	1463	51	5
Dodson855_48	1599	23	1583	50	1
Dodson855_49	1199	26	1079	41	10
Dodson855_50	1767	39	730	39	59
Dodson855_51	1489	27	1406	44	6
Dodson855_52	614	24	547	31	11
Dodson855_53	1220	22	1202	42	1
Plug 7-Bed 93					
Dodson855_1	980	19	998	35	2
Dodson855_2	1169	23	1173	34	0
Dodson855_3	1459	24	1442	40	1
Dodson855_4	1502	23	1281	36	15

Dodson855_5	1313	26	1328	46	1
Dodson855_6	1444	22	1327	42	8
Dodson855_7	1042	18	1048	29	1
Dodson855_8	1344	32	910	30	32
Dodson855_9	1098	21	1083	32	1
Dodson855_10	1435	26	1455	52	1
Dodson855_11	1454	24	655	29	55
Dodson855_12	978	28	970	36	1
Dodson855_13	1163	26	1135	35	2
Dodson855_14	1131	25	1143	41	1
Dodson855_15	1295	18	1296	34	0
Dodson855_16	1188	19	1165	37	2
Dodson855_17	999	23	1010	27	1
Dodson855_18	1162	22	1154	37	1
Dodson855_19	1625	33	1611	53	1
Dodson855_20	1033	21	1018	34	1
Dodson855_21	1141	30	1152	56	1
Dodson855_22	1086	25	961	34	12
Dodson855_23	1597	32	1182	42	26
Dodson855_24	1323	23	1323	44	0
Dodson855_25	1501	35	1412	38	6
Dodson855_26	1157	25	1155	40	0
Dodson855_27	1469	23	1487	49	1
Dodson855_28	1391	25	1402	42	1
Dodson855_29	1440	23	1468	41	2
Dodson855_30	1058	24	1068	40	1
Dodson855_31	1136	19	1141	31	0
Dodson855_32	1200	26	1001	33	17
Dodson855_33	1107	23	1072	42	3
Dodson855_34	1335	24	1275	40	4
Dodson855_35	1370	18	1382	43	1
Dodson855_36	1500	32	1192	46	21
Dodson855_37	1138	17	1159	36	2
Dodson855_38	1071	59	462	17	57
Dodson855_39	1413	21	1351	41	4
Dodson855_40	1070	20	988	31	8
Dodson855_41	1504	38	804	37	47
Dodson855_42	2373	43	1108	80	53
Dodson855_43	1375	27	1386	57	1
Dodson855_44	1436	22	1464	46	2
Dodson855_45	1081	19	1087	31	1
Dodson855_46	1150	19	1162	32	1
Dodson855_47	1452	22	1450	43	0
Dodson855_48	1294	31	1065	39	18

Dodson855_49	1224	23	1210	44	1
Dodson855_50	1445	27	1462	47	1
Dodson855_51	1057	19	1072	30	1
Dodson855_52	1106	25	1098	41	1
Dodson855_53	1058	28	976	36	8

Table A6. U-Pb Ages: Nebo, VA Section

Sample ID	$^{207}Pb/^{235}U$ (Ma)	±2σ (Ma)	$^{206}Pb/^{238}U$ (Ma)	±2σ (Ma)	Discordance (%)
Plug 8					
NeboVA_1	1173	30	1246	66	6
NeboVA_2	838	26	584	31	30
NeboVA_3	1091	21	1113	35	2
NeboVA_4	1091	22	1100	32	1
NeboVA_5	1054	23	1078	38	2
NeboVA_6	1140	22	1153	39	1
NeboVA_7	970	26	991	40	2
NeboVA_8	1463	24	1499	49	2
NeboVA_9	953	23	967	39	1
NeboVA_10	844	36	651	53	23
NeboVA_11	1085	24	1097	45	1
NeboVA_12	1339	28	1344	51	0
NeboVA_13	1066	26	1076	43	1
NeboVA_14	1583	87	1226	64	23
NeboVA_15	1197	23	1220	41	2
NeboVA_16	1099	22	1116	40	2
NeboVA_17	1088	28	1093	38	0
NeboVA_18	1034	27	1031	39	0
NeboVA_19	766	23	394	20	49
NeboVA_20	1228	29	1218	45	1
NeboVA_21	1076	27	1087	45	1
NeboVA_22	998	43	689	53	31
NeboVA_23	909	28	731	40	20
NeboVA_24	1096	31	937	47	15
NeboVA_25	1048	39	1017	48	3
NeboVA_26	1060	29	998	51	6
NeboVA_27	1015	40	1003	50	1
NeboVA_28	993	26	1029	34	4
NeboVA_29	1074	27	1089	43	1
NeboVA_30	1110	31	1108	50	0
NeboVA_31	1205	24	1236	44	3
NeboVA_32	1198	27	1256	48	5
NeboVA_33	1033	27	992	42	4
NeboVA_34	1040	27	754	35	28
NeboVA_35	1139	25	1173	44	3
NeboVA_36	1140	26	1104	39	3
NeboVA_37	1077	25	1100	37	2
NeboVA_38	1222	29	1248	52	2
NeboVA_39	1315	29	1350	55	3
NeboVA_40	1337	34	1346	55	1

NeboVA_41	1386	32	1393	56	1
NeboVA_42	1423	24	1465	44	3
NeboVA_43	1096	25	1102	40	1
NeboVA_44	1066	45	816	36	23
NeboVA_45	1059	25	1081	43	2
NeboVA_46	1051	21	1020	34	3
NeboVA_47	1013	27	818	35	19
NeboVA_48	1324	25	1319	39	0
NeboVA_49	1035	23	1053	36	2
NeboVA_50	1062	27	1069	45	1
NeboVA_51	1238	25	1277	41	3
NeboVA_52	1462	25	1476	50	1
NeboVA_53	1012	25	1006	40	1
NeboVA_54	1029	22	1046	32	2
NeboVA_55	1036	34	1051	39	1
NeboVA_56	1024	22	1048	35	2
NeboVA_57	1225	22	1129	40	8
NeboVA_58	1007	26	1027	40	2
NeboVA_59	1368	30	1347	59	2
NeboVA_60	1081	26	1067	44	1
NeboVA_61	1059	26	1085	45	2
NeboVA_62	1315	24	1296	41	1
NeboVA_63	1054	23	1075	39	2
NeboVA_64	1055	20	1064	33	1
NeboVA_65	1413	27	1461	46	3
NeboVA_66	1035	18	1051	30	2
NeboVA_67	1074	20	1090	32	1
NeboVA_68	1044	22	1057	30	1
NeboVA_69	853	26	533	28	38
NeboVA_70	1006	21	1022	33	2
NeboVA_71	1061	26	593	28	44
NeboVA_72	1391	29	1372	53	1
NeboVA_73	1307	33	1346	51	3
NeboVA_74	1307	35	1179	57	10
NeboVA_75	1047	20	1065	30	2
NeboVA_76	1113	28	1108	45	0
NeboVA_77	999	28	723	41	28
NeboVA_78	1059	20	1098	34	4
NeboVA_79	1077	34	1123	54	4
NeboVA_80	1407	45	1371	65	3
NeboVA_81	938	32	703	40	25
NeboVA_82	1171	29	1209	51	3
NeboVA_83	1240	29	1274	54	3
NeboVA_84	943	33	806	39	15

NeboVA_85	1319	27	1317	53	0
NeboVA_86	1266	25	1286	38	2
NeboVA_87	1096	31	1124	52	3
NeboVA_88	988	22	959	36	3
NeboVA_89	1152	23	1170	39	2
NeboVA_90	1094	26	940	42	14
NeboVA_91	1186	30	1220	45	3
NeboVA_92	1047	25	1049	36	0
NeboVA_93	1199	21	1205	41	1
NeboVA_94	1032	21	1064	36	3
NeboVA_95	1456	35	1448	59	1
NeboVA_96	1599	35	1618	62	1
NeboVA_97	1122	27	1115	44	1
NeboVA_98	1005	23	1016	37	1
NeboVA_99	1164	29	1203	51	3
NeboVA_100	1438	31	1419	61	1
NeboVA_101	1407	35	1420	56	1
NeboVA_102	1378	21	1370	39	1
NeboVA_103	882	27	716	35	19
NeboVA_104	1092	27	608	26	44
NeboVA_105	1020	20	1037	35	2
NeboVA_106	1380	24	1415	43	3
NeboVA_107	1419	18	1458	38	3
NeboVA_108	1160	23	1171	32	1
NeboVA_109	1122	21	1131	35	1
NeboVA_110	998	30	1026	37	3
NeboVA_111	1160	23	1157	39	0
NeboVA_112	1374	27	1392	46	1
NeboVA_113	991	18	995	30	0
NeboVA_114	1143	33	1179	51	3
NeboVA_115	1228	24	1229	46	0
NeboVA_116	1200	26	1247	45	4
NeboVA_117	1134	37	931	39	18
NeboVA_118	1259	30	1274	51	1
NeboVA_119	1276	31	1267	56	1
NeboVA_120	1150	32	1167	54	1
NeboVA_121	1223	27	1222	46	0
NeboVA_122	1191	25	1200	47	1
NeboVA_123	1191	32	1182	47	1
NeboVA_124	1185	22	1213	41	2
NeboVA_125	994	31	985	46	1
NeboVA_126	1024	28	808	40	21
NeboVA_127	1153	30	1149	55	0
NeboVA_128	1130	28	1136	45	1

NeboVA_129	1239	35	1134	51	8
NeboVA_130	1047	23	1056	35	1
NeboVA_131	1147	37	1136	47	1
NeboVA_132	1423	49	1419	57	0
NeboVA_133	1286	27	1276	49	1
NeboVA_134	1139	24	1166	44	2
NeboVA_135	1131	24	1164	38	3
NeboVA_136	1049	29	1069	47	2
NeboVA_137	1151	29	1157	48	1
NeboVA_138	1087	28	1096	47	1
NeboVA_139	1251	30	1278	55	2
NeboVA_140	999	27	991	43	1
NeboVA_141	1109	27	1114	50	0
NeboVA_142	1186	25	1198	42	1
NeboVA_143	961	35	957	49	0
NeboVA_144	1153	34	1175	56	2
NeboVA_145	1267	37	1168	58	8
NeboVA_146	1159	23	1154	43	0
NeboVA_147	1398	35	1328	57	5
NeboVA_148	1331	35	1367	55	3
NeboVA_149	1161	27	1174	45	1
NeboVA_150	953	27	969	43	2
NeboVA_151	1148	57	1062	41	7
NeboVA_152	1039	26	1067	40	3
NeboVA_153	1154	26	1183	44	3
NeboVA_154	1253	27	1267	51	1
NeboVA_155	1427	31	1439	60	1
NeboVA_156	912	23	724	29	21
NeboVA_157	1181	34	782	41	34
NeboVA_158	1005	28	810	40	19
NeboVA_159	1043	35	1057	54	1
NeboVA_160	1078	23	1102	33	2
NeboVA_161	1063	29	1072	45	1
NeboVA_162	1223	35	1203	59	2
NeboVA_163	1196	32	1215	49	2
NeboVA_164	1162	27	1185	41	2
NeboVA_165	1162	28	1183	46	2
NeboVA_166	1469	26	1484	57	1
NeboVA_167	1459	32	1474	55	1
NeboVA_168	1309	37	1317	71	1
NeboVA_169	1163	22	1177	39	1
NeboVA_170	1157	19	1150	33	1
NeboVA_171	769	29	544	29	29
NeboVA_172	1178	29	1174	43	0

NeboVA_173	1176	27	1210	47	3
NeboVA_174	810	25	706	37	13
NeboVA_175	1393	31	1427	57	2
NeboVA_176	1473	30	1473	58	0
NeboVA_177	1295	27	1295	41	0
NeboVA_178	1228	31	1229	53	0
NeboVA_179	1227	29	1238	54	1
NeboVA_180	1230	27	1243	55	1
NeboVA_181	1187	30	1209	52	2
NeboVA_182	974	23	989	35	2
NeboVA_183	1161	31	1147	49	1
NeboVA_184	1236	30	1230	57	0
NeboVA_185	1209	26	1236	42	2
NeboVA_186	1093	24	1137	42	4
NeboVA_187	1377	63	1126	62	18
NeboVA_188	1166	31	1158	53	1
NeboVA_189	1036	29	1045	52	1
NeboVA_190	997	31	1017	49	2
NeboVA_191	1127	40	1066	55	5
NeboVA_192	1312	32	1273	50	3
NeboVA_193	1272	29	1251	44	2
NeboVA_194	1074	28	1087	44	1
NeboVA_195	1064	26	1058	42	1
NeboVA_196	1149	38	1173	56	2
NeboVA_197	1144	24	1172	45	2

Table A7. U-Pb Ages: Crockett Cove, VA Section

Sample ID	$^{207}Pb/^{235}U$ (Ma)	±2σ (Ma)	$^{206}Pb/^{238}U$ (Ma)	±2σ (Ma)	Discordance (%)
Plug 1					
WalkerMtn_1	1319	35	1269	60	4
WalkerMtn_2	1136	35	1133	47	0
WalkerMtn_3	1192	38	1140	48	4
WalkerMtn_4	2135	42	1398	52	35
WalkerMtn_5	1340	26	1319	42	2
WalkerMtn_6	1087	28	1048	35	4
WalkerMtn_7	1118	24	1057	25	5
WalkerMtn_8	1259	22	1159	35	8
WalkerMtn_9	1466	42	1480	49	1
WalkerMtn_10	1936	56	1303	51	33
WalkerMtn_11	1158	23	1171	32	1
WalkerMtn_12	1193	23	1171	40	2
WalkerMtn_13	1493	34	1466	42	2
WalkerMtn_14	1080	22	1073	37	1
WalkerMtn_15	1049	29	1042	35	1
WalkerMtn_16	948	20	933	29	2
WalkerMtn_17	969	29	951	28	2
WalkerMtn_18	988	17	970	28	2
WalkerMtn_19	2676	26	2651	70	1
WalkerMtn_20	1631	39	1241	48	24
WalkerMtn_21	1605	35	1259	35	22
WalkerMtn_22	1211	24	1166	35	4
WalkerMtn_23	1089	26	1058	37	3
WalkerMtn_24	1060	18	1051	25	1
WalkerMtn_25	1116	32	1104	32	1
WalkerMtn_26	1185	25	1128	30	5
WalkerMtn_27	1288	28	1289	34	0
WalkerMtn_28	1043	18	1048	23	0
WalkerMtn_29	1693	53	1192	35	30
WalkerMtn_30	974	20	984	23	1
WalkerMtn_31	1029	17	1024	24	0
WalkerMtn_32	2190	38	676	29	69
WalkerMtn_33	1376	52	1024	35	26
WalkerMtn_34	1479	21	1447	39	2
WalkerMtn_35	1445	21	1475	44	2
WalkerMtn_36	3310	42	1832	55	45
WalkerMtn_37	1165	18	1160	35	0
WalkerMtn_38	1175	34	1132	36	4
WalkerMtn_39	2573	46	905	35	65
WalkerMtn_40	2695	99	1574	70	42

WalkerMtn_41	1465	38	1375	43	6
WalkerMtn_42	4541	39	4270	120	6
WalkerMtn_43	1031	16	1025	29	1
WalkerMtn_44	1042	19	1040	27	0
WalkerMtn_45	2989	59	1847	71	38
WalkerMtn_46	1288	24	1263	26	2
WalkerMtn_47	1250	24	1233	36	1
WalkerMtn_48	1153	18	1154	28	0
WalkerMtn_49	1137	19	1154	23	1
WalkerMtn_50	1024	23	980	28	4
WalkerMtn_51	1487	16	1495	25	1
WalkerMtn_52	3346	45	2080	62	38
WalkerMtn_53	1453	22	1441	34	1
WalkerMtn_54	996	16	1010	25	1
WalkerMtn_55	1637	35	1107	30	32
WalkerMtn_56	1275	18	1191	26	7
WalkerMtn_57	1002	21	1007	25	0
WalkerMtn_58	1136	29	1005	34	12
WalkerMtn_59	1580	26	1339	39	15
WalkerMtn_60	3033	34	1340	48	56
WalkerMtn_61	1308	21	1100	27	16
WalkerMtn_62	1138	18	1135	30	0
WalkerMtn_63	1759	27	530	18	70
WalkerMtn_64	1226	22	1199	31	2
WalkerMtn_65	1248	18	1246	30	0
WalkerMtn_66	1352	21	1360	34	1
WalkerMtn_67	2270	49	1536	44	32
WalkerMtn_68	1150	24	1137	34	1
WalkerMtn_69	1293	25	1222	36	5
WalkerMtn_70	1042	25	1006	27	3
WalkerMtn_71	1150	23	1038	27	10
WalkerMtn_72	1972	28	1718	44	13
WalkerMtn_73	3190	37	2559	84	20
WalkerMtn_74	1279	21	1286	31	1
WalkerMtn_75	4180	240	3900	440	7
WalkerMtn_76	1021	29	1021	40	0
WalkerMtn_77	1097	23	1106	35	1
WalkerMtn_78	2335	51	1061	54	55
WalkerMtn_79	1229	30	1200	46	2
WalkerMtn_80	2540	150	1496	67	41
WalkerMtn_81	1738	22	1458	41	16
WalkerMtn_82	1124	28	1113	29	1
WalkerMtn_83	2904	61	1717	72	41
WalkerMtn_84	1531	31	1100	28	28

WalkerMtn_85	1272	37	1027	27	19
WalkerMtn_86	1450	21	1432	35	1
WalkerMtn_87	1569	25	1436	41	8
WalkerMtn_88	1519	21	1385	36	9
WalkerMtn_89	1235	22	1171	28	5
WalkerMtn_90	1494	22	1327	32	11
WalkerMtn_91	3230	34	1817	54	44
WalkerMtn_92	1050	18	1029	31	2
WalkerMtn_93	1291	18	1286	31	0
WalkerMtn_94	1509	51	1144	36	24
WalkerMtn_95	1081	44	1036	52	4
WalkerMtn_96	1032	22	983	28	5
WalkerMtn_97	1447	60	1402	70	3
WalkerMtn_98	2526	35	849	28	66
WalkerMtn_99	1834	29	1819	50	1
WalkerMtn_100	1450	110	1178	41	19
WalkerMtn_101	2690	120	1600	110	41
WalkerMtn_102	2000	210	1433	87	28
WalkerMtn_103	1045	35	1033	46	1
WalkerMtn_104	1493	27	1461	52	2
WalkerMtn_105	995	30	963	37	3
WalkerMtn_106	1294	53	997	32	23
WalkerMtn_107	2543	90	1647	80	35
WalkerMtn_108	1751	42	1297	42	26
WalkerMtn_109	1114	32	1018	40	9
WalkerMtn_110	2711	63	1395	52	49
WalkerMtn_111	1101	24	1117	41	1
WalkerMtn_112	1844	83	1099	52	40
WalkerMtn_113	1445	23	1337	48	7
WalkerMtn_114	1187	30	1176	42	1
WalkerMtn_115	1188	30	1176	47	1
WalkerMtn_116	1393	37	1229	50	12
WalkerMtn_117	1753	80	1267	87	28
WalkerMtn_118	1301	30	1276	40	2
WalkerMtn_119	2390	170	1610	110	33
WalkerMtn_120	1359	22	1329	38	2
WalkerMtn_121	929	27	907	27	2
WalkerMtn_122	2310	250	1450	130	37
WalkerMtn_123	1016	21	1008	35	1
WalkerMtn_124	1286	27	1252	45	3
WalkerMtn_125	2507	78	1341	56	47
WalkerMtn_126	962	28	934	29	3
WalkerMtn_127	909	24	908	26	0
WalkerMtn_128	1007	23	939	29	7

WalkerMtn_129	1673	38	1186	24	29
WalkerMtn_130	1056	31	1009	28	4
WalkerMtn_131	1920	120	1261	43	34
WalkerMtn_132	1188	27	1168	42	2
WalkerMtn_133	1636	51	635	31	61
WalkerMtn_134	1191	30	1149	44	4
WalkerMtn_135	1144	25	1030	28	10
WalkerMtn_136	5750	130	8660	630	51
WalkerMtn_137	1094	28	1103	37	1
WalkerMtn_138	1224	23	1209	35	1
WalkerMtn_139	1306	26	1286	33	2
WalkerMtn_140	2568	52	1339	50	48
WalkerMtn_141	1685	63	1196	39	29
WalkerMtn_142	978	20	986	25	1
WalkerMtn_143	1188	24	1159	33	2
WalkerMtn_144	1603	31	1187	38	26
WalkerMtn_145	1428	24	1422	42	0
WalkerMtn_146	1643	22	1446	39	12
WalkerMtn_147	1963	28	1241	29	37
WalkerMtn_148	1235	20	1126	28	9
WalkerMtn_149	1410	22	1400	40	1
WalkerMtn_150	1024	17	1012	25	1
WalkerMtn_151	2100	160	1065	70	49
WalkerMtn_152	1079	22	1063	37	1
WalkerMtn_153	2493	34	1342	30	46
WalkerMtn_154	2366	23	2386	61	1
WalkerMtn_155	1388	19	1363	35	2
WalkerMtn_156	1631	40	1302	32	20
WalkerMtn_157	2640	140	1831	71	31
WalkerMtn_158	1132	22	1132	34	0
WalkerMtn_159	1081	21	1090	33	1
WalkerMtn_160	1063	15	1060	23	0
WalkerMtn_161	1098	32	1102	34	0
WalkerMtn_162	1097	25	1090	32	1
WalkerMtn_163	1245	26	1201	34	4
WalkerMtn_164	2339	37	1521	38	35
WalkerMtn_165	1029	15	1025	28	0
WalkerMtn_166	3761	48	2508	88	33
WalkerMtn_167	2536	65	1177	47	54
WalkerMtn_168	2433	30	1017	30	58
WalkerMtn_169	1611	51	1340	37	17
WalkerMtn_170	1015	28	1005	29	1
WalkerMtn_171	1001	19	995	25	1
WalkerMtn_172	1133	24	1142	34	1

WalkerMtn_173	1079	18	1013	22	6
WalkerMtn_174	1147	17	1144	29	0
WalkerMtn_175	2296	96	1349	56	41
WalkerMtn_176	1293	27	1263	34	2
WalkerMtn_177	1005	23	992	29	1
WalkerMtn_178	1303	77	1169	54	10
WalkerMtn_179	1405	27	1341	45	5
WalkerMtn_180	2293	32	1058	34	54
WalkerMtn_181	1239	21	1216	37	2
WalkerMtn_182	1437	23	1389	40	3
WalkerMtn_183	2387	49	933	36	61
WalkerMtn_184	1727	28	1434	48	17
WalkerMtn_185	2189	95	1577	58	28
WalkerMtn_186	1410	27	1418	49	1
WalkerMtn_187	1403	26	1389	42	1
WalkerMtn_188	1396	33	1005	34	28
WalkerMtn_189	1262	30	1285	41	2
WalkerMtn_190	1125	20	1136	32	1
WalkerMtn_191	2650	50	1254	44	53
WalkerMtn_192	2410	38	1344	45	44
WalkerMtn_193	1110	20	1041	29	6
WalkerMtn_194	983	25	989	28	1
WalkerMtn_195	1000	28	988	30	1
WalkerMtn_196	5236	48	6340	200	21
WalkerMtn_197	1384	29	1163	34	16
WalkerMtn_198	1185	27	1165	45	2

Table A8. U-Pb Ages: Gap Mountain, VA Section

Sample ID	$^{207}Pb/^{235}U$ (Ma)	±2σ (Ma)	$^{206}Pb/^{238}U$ (Ma)	±2σ (Ma)	Discordance (%)
LA 20150810 -Gap-Walker Mtn 2					
GapMtnSst_1	1081	20	978	15	10
GapMtnSst_2	1199	41	979	18	18
GapMtnSst_3	1135	18	1008	17	11
GapMtnSst_4	998	16	969	13	3
GapMtnSst_5	1162	16	1117	17	4
GapMtnSst_6	1080	14	970	16	10
GapMtnSst_7	1032	15	1014	13	2
GapMtnSst_8	1011	14	868	16	14
GapMtnSst_9	1075	20	1074	19	0
GapMtnSst_10	1196	20	1126	17	6
GapMtnSst_11	1474	19	1398	23	5
GapMtnSst_12	1165	17	1072	19	8
GapMtnSst_13	1134	14	1098	14	3
GapMtnSst_14	1015	16	972	14	4
GapMtnSst_15	1296	17	1234	23	5
GapMtnSst_16	1288	20	1153	18	10
GapMtnSst_17	1087	13	1041	14	4
GapMtnSst_18	1156	16	1089	16	6
GapMtnSst_19	1142	13	951	11	17
GapMtnSst_20	1116	13	1072	13	4
GapMtnSst_21	1240	12	1165	16	6
GapMtnSst_22	1556	24	1187	17	24
GapMtnSst_23	797	28	444	9	44
GapMtnSst_24	971	18	969	13	0
GapMtnSst_25	1151	19	1006	14	13
GapMtnSst_26	1072	24	984	16	8
GapMtnSst_27	1671	15	1640	21	2
GapMtnSst_28	1336	18	1182	17	12
GapMtnSst_29	1017	20	925	13	9
GapMtnSst_30	1158	13	1130	14	2
GapMtnSst_31	455	13	270	13	41
GapMtnSst_32	1044	28	923	19	12
GapMtnSst_33	1075	17	1004	13	7
GapMtnSst_34	1046	18	1006	13	4
GapMtnSst_35	1190	17	1030	13	13
GapMtnSst_36	1076	13	987	12	8
GapMtnSst_37	988	16	743	18	25
GapMtnSst_38	2526	30	2294	49	9
GapMtnSst_39	1070	13	975	14	9
GapMtnSst_40	1070	28	979	18	9

GapMtnSst_41	1293	20	1226	17	5
GapMtnSst_42	1287	18	1181	20	8
GapMtnSst_43	1288	14	1257	15	2
GapMtnSst_44	1111	15	1005	13	10
GapMtnSst_45	1052	15	1025	14	3
GapMtnSst_46	1252	22	1190	24	5
GapMtnSst_47	1177	35	874	18	26
GapMtnSst_48	1066	30	902	17	15
GapMtnSst_49	1365	17	1307	18	4
GapMtnSst_50	1251	26	1191	22	5
GapMtnSst_51	1081	18	1055	15	2
LA 20150812 Gap Mtn-Walker Corr					
GapWalkerMtnSst_1	1322	18	1314	16	1
GapWalkerMtnSst_2	1111	33	992	19	11
GapWalkerMtnSst_3	345	7	199	5	42
GapWalkerMtnSst_4	1085	17	1024	11	6
GapWalkerMtnSst_5	1371	16	1346	16	2
GapWalkerMtnSst_6	1174	17	1152	14	2
GapWalkerMtnSst_7	820	13	486	10	41
GapWalkerMtnSst_8	1114	12	965	14	13
GapWalkerMtnSst_9	1114	15	980	14	12
GapWalkerMtnSst_10	1073	16	1029	16	4
GapWalkerMtnSst_11	968	13	751	14	22
GapWalkerMtnSst_12	1375	18	1320	18	4
GapWalkerMtnSst_13	1032	14	996	10	3
GapWalkerMtnSst_14	1030	12	994	12	3
GapWalkerMtnSst_15	1124	21	985	15	12
GapWalkerMtnSst_16	1173	21	1054	17	10
GapWalkerMtnSst_17	1064	18	1040	15	2
GapWalkerMtnSst_18	3890	120	3420	220	12
GapWalkerMtnSst_19	1084	17	1075	15	1
GapWalkerMtnSst_20	1211	24	1196	18	1
GapWalkerMtnSst_21	1047	19	1031	16	2
GapWalkerMtnSst_22	1351	22	1360	23	1
GapWalkerMtnSst_23	1144	40	991	21	13
GapWalkerMtnSst_24	1022	20	1001	17	2
GapWalkerMtnSst_25	1056	17	1006	15	5
GapWalkerMtnSst_26	1344	16	1280	20	5
GapWalkerMtnSst_27	1082	17	1030	15	5
GapWalkerMtnSst_28	1256	19	1198	19	5
GapWalkerMtnSst_29	1401	28	1201	22	14
GapWalkerMtnSst_30	1094	14	1000	15	9
GapWalkerMtnSst_31	1441	26	1403	22	3
GapWalkerMtnSst_32	1185	12	1176	18	1

GapWalkerMtnSst_33	949	19	960	14	1
GapWalkerMtnSst_34	1268	18	1182	17	7
GapWalkerMtnSst_35	1507	29	1128	22	25
GapWalkerMtnSst_36	1134	15	781	11	31
GapWalkerMtnSst_37	1258	24	1086	18	14
GapWalkerMtnSst_38	1158	18	1120	17	3
GapWalkerMtnSst_39	1218	17	1123	17	8
GapWalkerMtnSst_40	1396	20	1351	20	3
GapWalkerMtnSst_41	1060	17	1044	16	2
GapWalkerMtnSst_42	1069	14	1034	18	3
GapWalkerMtnSst_43	1171	28	958	14	18
GapWalkerMtnSst_44	1009	19	1001	16	1
GapWalkerMtnSst_45	1031	19	1009	16	2
GapWalkerMtnSst_46	1359	13	1326	19	2
GapWalkerMtnSst_47	1064	20	1007	15	5
GapWalkerMtnSst_48	1097	24	888	16	19
GapWalkerMtnSst_49	1100	25	1053	19	4
GapWalkerMtnSst_50	1019	20	1002	15	2
GapWalkerMtnSst_51	1023	15	1002	15	2
GapWalkerMtnSst_52	1061	12	1045	14	2
GapWalkerMtnSst_53	1085	27	1055	17	3
GapWalkerMtnSst_54	1038	17	1021	15	2
GapWalkerMtnSst_55	963	22	941	14	2
GapWalkerMtnSst_56	1403	25	1381	20	2
GapWalkerMtnSst_57	1085	18	1065	14	2
GapWalkerMtnSst_58	1471	13	1412	16	4
GapWalkerMtnSst_59	1027	26	1010	16	2
GapWalkerMtnSst_60	1372	25	1304	17	5
GapWalkerMtnSst_61	1672	26	1566	24	6
GapWalkerMtnSst_62	1144	28	966	16	16
GapWalkerMtnSst_63	1075	11	1018	11	5
GapWalkerMtnSst_64	1112	14	1095	13	2
GapWalkerMtnSst_65	1225	25	1070	18	13
GapWalkerMtnSst_66	1042	11	1016	11	2
GapWalkerMtnSst_67	1516	19	1471	17	3
GapWalkerMtnSst_68	1245	16	1206	15	3
GapWalkerMtnSst_69	1149	13	1107	13	4
GapWalkerMtnSst_70	1217	17	1115	15	8
GapWalkerMtnSst_71	1101	10	1098	12	0
GapWalkerMtnSst_72	1426	18	1342	18	6
GapWalkerMtnSst_73	1509	17	1361	18	10
GapWalkerMtnSst_74	1266	19	1213	15	4
GapWalkerMtnSst_75	1427	24	1370	20	4
GapWalkerMtnSst_76	1709	16	1615	20	6

GapWalkerMtnSst_77	1087	22	974	12	10
GapWalkerMtnSst_78	1068	17	1026	13	4
GapWalkerMtnSst_79	1126	22	1099	14	2
GapWalkerMtnSst_80	1764	12	1761	18	0
GapWalkerMtnSst_81	1094	14	1082	13	1
GapWalkerMtnSst_82	1310	11	1303	14	1
GapWalkerMtnSst_83	1819	11	1739	17	4
GapWalkerMtnSst_84	1370	22	1320	16	4
GapWalkerMtnSst_85	1060	18	1037	11	2
GapWalkerMtnSst_86	1062	14	1023	10	4
GapWalkerMtnSst_87	1059	16	1025	11	3
GapWalkerMtnSst_88	1335	35	1183	19	11
GapWalkerMtnSst_89	1084	11	1023	11	6
GapWalkerMtnSst_90	1451	14	1432	14	1
GapWalkerMtnSst_91	1396	41	1130	21	19
GapWalkerMtnSst_92	1476	19	1451	17	2
GapWalkerMtnSst_93	1015	25	996	17	2
GapWalkerMtnSst_94	1412	58	1324	33	6
GapWalkerMtnSst_95	1049	15	1019	10	3
GapWalkerMtnSst_96	1325	11	1176	13	11
GapWalkerMtnSst_97	455	12	452	5	1
GapWalkerMtnSst_98	1047	14	1003	12	4
GapWalkerMtnSst_99	1455	18	1402	16	4
GapWalkerMtnSst_100	934	46	934	21	0
GapWalkerMtnSst_101	1069	19	1001	13	6
GapWalkerMtnSst_102	1040	25	1048	15	1
GapWalkerMtnSst_103	1025	16	998	12	3
GapWalkerMtnSst_104	1231	24	1210	18	2
GapWalkerMtnSst_105	1458	15	1470	14	1
GapWalkerMtnSst_106	1330	15	1276	15	4
GapWalkerMtnSst_107	1057	23	1014	15	4
GapWalkerMtnSst_108	1192	24	992	17	17
GapWalkerMtnSst_109	1133	20	1066	15	6
GapWalkerMtnSst_110	1481	16	1447	18	2
GapWalkerMtnSst_111	1522	12	1482	15	3
GapWalkerMtnSst_112	1272	21	1073	17	16
GapWalkerMtnSst_113	1047	19	1059	17	1
GapWalkerMtnSst_114	1049	24	1024	16	2
GapWalkerMtnSst_115	1173	28	1175	19	0
GapWalkerMtnSst_116	1270	40	1306	26	3
GapWalkerMtnSst_117	1327	21	1312	21	1
GapWalkerMtnSst_118	1190	28	1072	20	10
GapWalkerMtnSst_119	2646	21	2617	37	1
GapWalkerMtnSst_120	1050	14	1028	16	2

GapWalkerMtnSst_121	1333	19	1298	19	3
GapWalkerMtnSst_122	1103	22	1039	17	6
GapWalkerMtnSst_123	1097	22	1004	15	8
GapWalkerMtnSst_124	1218	17	1116	15	8
GapWalkerMtnSst_125	1204	22	1068	19	11
GapWalkerMtnSst_126	1057	13	1048	15	1
GapWalkerMtnSst_127	1018	19	992	15	3
GapWalkerMtnSst_128	526	19	479	12	9
GapWalkerMtnSst_129	1088	19	988	16	9
GapWalkerMtnSst_130	1084	17	1024	14	6
GapWalkerMtnSst_131	503	15	437	7	13
GapWalkerMtnSst_132	1059	23	1029	17	3
GapWalkerMtnSst_133	1232	21	1171	19	5
GapWalkerMtnSst_134	1555	18	1431	20	8
GapWalkerMtnSst_135	1059	10	1036	13	2
GapWalkerMtnSst_136	1251	20	1237	17	1
GapWalkerMtnSst_137	1304	17	1275	17	2
GapWalkerMtnSst_138	1395	15	1366	16	2
GapWalkerMtnSst_139	1257	15	1165	17	7
GapWalkerMtnSst_140	1054	20	1017	14	4
GapWalkerMtnSst_141	1224	22	1180	17	4
GapWalkerMtnSst_142	1482	18	1476	20	0
GapWalkerMtnSst_143	1762	18	1724	27	2
GapWalkerMtnSst_144	1088	15	1093	16	0
GapWalkerMtnSst_145	1232	25	1191	21	3
GapWalkerMtnSst_146	1108	21	1089	16	2
GapWalkerMtnSst_147	1339	18	1311	18	2
GapWalkerMtnSst_148	1270	15	1228	15	3
GapWalkerMtnSst_149	1181	13	1172	14	1
GapWalkerMtnSst_150	1124	23	1086	18	3
GapWalkerMtnSst_151	1105	19	1088	16	2
GapWalkerMtnSst_152	1185	19	1134	16	4
GapWalkerMtnSst_153	1133	12	1064	16	6
GapWalkerMtnSst_154	1098	11	1079	11	2
GapWalkerMtnSst_155	1251	25	1143	17	9
GapWalkerMtnSst_156	1327	15	1335	15	1
GapWalkerMtnSst_157	1256	12	1227	15	2
GapWalkerMtnSst_158	1056	18	1029	13	3

Table A9. U-Pb Ages: Ellett, VA Section

Sample ID	$^{207}Pb/^{235}U$ (Ma)	±2σ (Ma)	$^{206}Pb/^{238}U$ (Ma)	±2σ (Ma)	Discordance (%)
Plug 7					
EllettVA_1	1098	27	1051	29	4
EllettVA_2	1384	26	1184	29	14
EllettVA_3	1120	23	1093	39	2
EllettVA_4	1384	90	1097	43	21
EllettVA_5	1045	21	1057	36	1
EllettVA_6	1365	27	1306	43	4
EllettVA_7	1227	19	1252	38	2
EllettVA_8	1064	15	1074	27	1
EllettVA_9	4240	220	3980	420	6
EllettVA_10	1111	21	1122	31	1
EllettVA_11	1262	26	1102	34	13
EllettVA_12	1286	22	1239	35	4
EllettVA_13	1486	26	1456	43	2
EllettVA_14	1371	22	1375	41	0
EllettVA_15	999	19	988	25	1
EllettVA_16	6329	86	10860	430	72
EllettVA_17	1562	37	1049	35	33
EllettVA_18	1051	18	1034	26	2
EllettVA_19	1169	25	1159	39	1
EllettVA_20	1174	22	1198	39	2
EllettVA_21	1450	22	1449	35	0
EllettVA_22	1455	19	1467	32	1
EllettVA_23	1326	26	1159	42	13
EllettVA_24	1589	22	1589	44	0
EllettVA_25	1555	22	1594	42	3
EllettVA_26	2360	140	1648	88	30
EllettVA_27	1431	26	1279	37	11
EllettVA_28	1253	22	1281	48	2
EllettVA_29	1309	26	1314	42	0
EllettVA_30	1007	17	1010	27	0
EllettVA_31	1152	19	1162	35	1
EllettVA_32	1164	24	1170	39	1
EllettVA_33	1192	45	1148	36	4
EllettVA_34	2676	22	2663	63	0
EllettVA_35	2571	56	1218	55	53
EllettVA_36	1166	18	1166	33	0
EllettVA_37	2788	38	2545	86	9
EllettVA_38	1183	18	1178	32	0
EllettVA_39	1045	36	979	33	6
EllettVA_40	1247	37	941	34	25

EllettVA_41	1149	20	1163	30	1
EllettVA_42	1138	17	1158	31	2
EllettVA_43	1168	20	1172	33	0
EllettVA_44	1164	18	1162	33	0
EllettVA_45	1076	18	1078	31	0
EllettVA_46	1047	20	1050	30	0
EllettVA_47	1316	19	1311	32	0
EllettVA_48	2654	49	1277	53	52
EllettVA_49	1087	24	1001	28	8
EllettVA_50	1451	23	1192	42	18
EllettVA_51	1218	28	1118	31	8
EllettVA_52	1195	22	1199	39	0
EllettVA_53	1253	17	1150	25	8
EllettVA_54	1313	29	1299	47	1
EllettVA_55	1854	36	1258	37	32
EllettVA_56	1133	21	1118	35	1
EllettVA_57	1221	22	1179	35	3
EllettVA_58	1237	23	1177	41	5
EllettVA_59	2590	130	1701	96	34
EllettVA_60	1445	26	1426	42	1
EllettVA_61	1144	17	1148	29	0
EllettVA_62	1139	18	1126	27	1
EllettVA_63	1046	17	1058	26	1
EllettVA_64	1170	21	1197	32	2
EllettVA_65	987	21	995	27	1
EllettVA_66	1478	27	1416	34	4
EllettVA_67	2466	49	1252	50	49
EllettVA_68	2758	80	1519	52	45
EllettVA_69	2847	99	1823	89	36
EllettVA_70	1476	21	1479	44	0
EllettVA_71	1587	33	960	30	40
EllettVA_72	1153	20	1159	35	1
EllettVA_73	1153	21	1139	36	1
EllettVA_74	1057	19	1074	32	2
EllettVA_75	1403	23	1389	39	1
EllettVA_76	1003	22	1021	32	2
EllettVA_77	1049	20	1042	31	1
EllettVA_78	1673	28	1191	34	29
EllettVA_79	1463	22	1467	39	0
EllettVA_80	1194	24	1169	36	2
EllettVA_81	2120	42	1076	35	49
EllettVA_82	963	19	954	25	1
EllettVA_83	1050	20	1069	29	2
EllettVA_84	1162	25	1160	34	0

EllettVA_85	991	15	1005	23	1
EllettVA_86	1006	21	963	28	4
EllettVA_87	1161	23	1153	35	1
EllettVA_88	993	21	983	28	1
EllettVA_89	1527	31	1260	36	17
EllettVA_90	1161	18	1153	33	1
EllettVA_91	1257	27	1260	39	0
EllettVA_92	1303	22	1290	37	1
EllettVA_93	1088	20	1057	29	3
EllettVA_94	1185	41	1037	30	12
EllettVA_95	1165	20	1184	31	2
EllettVA_96	1180	26	1171	35	1
EllettVA_97	1027	17	1042	24	1
EllettVA_98	1063	23	1082	31	2
EllettVA_99	1043	21	1054	27	1
EllettVA_100	1094	21	1083	30	1
EllettVA_101	1057	21	1063	39	1
EllettVA_102	1242	22	1245	36	0
EllettVA_103	1230	22	1237	33	1
EllettVA_104	1053	19	1058	31	0
EllettVA_105	1078	19	1109	32	3
EllettVA_106	1166	22	1152	35	1
EllettVA_107	1039	20	1048	25	1
EllettVA_108	1371	29	1105	32	19
EllettVA_109	994	19	1004	28	1
EllettVA_110	1014	18	1016	27	0
EllettVA_111	1199	25	1174	38	2
EllettVA_112	1437	24	1176	30	18
EllettVA_113	1208	29	1119	37	7
EllettVA_114	1455	23	1435	42	1
EllettVA_115	1156	20	1171	31	1
EllettVA_116	1504	26	914	29	39
EllettVA_117	1206	23	1195	41	1
EllettVA_118	2686	40	1154	42	57
EllettVA_119	1062	23	1048	32	1
EllettVA_120	1186	22	1186	35	0
EllettVA_121	1205	24	1221	44	1
EllettVA_122	1174	23	1039	33	11
EllettVA_123	2566	41	1289	61	50
EllettVA_124	961	23	958	35	0
EllettVA_125	2660	220	1760	140	34
EllettVA_126	1079	27	1066	43	1
EllettVA_127	1051	22	1049	34	0
EllettVA_128	1354	25	1195	33	12

EllettVA_129	1248	20	1176	30	6
EllettVA_130	2674	40	1124	45	58
EllettVA_131	1062	19	1042	24	2
EllettVA_132	2890	120	1854	99	36
EllettVA_133	1515	23	1508	40	0
EllettVA_134	1481	63	1131	46	24
EllettVA_135	1173	27	1171	38	0
EllettVA_136	1107	24	1114	36	1
EllettVA_137	1424	24	1426	41	0
EllettVA_138	1585	54	1336	33	16
EllettVA_139	2548	30	905	37	64
EllettVA_140	1071	25	757	22	29
EllettVA_141	1401	32	1397	53	0
EllettVA_142	1353	31	1308	47	3
EllettVA_143	1154	18	1160	34	1
EllettVA_144	1155	23	1149	36	1
EllettVA_145	1027	23	1040	40	1
EllettVA_146	1420	34	1061	39	25
EllettVA_147	1469	31	1060	36	28
EllettVA_148	1257	24	1174	39	7
EllettVA_149	3096	60	1316	73	57
EllettVA_150	1772	43	1105	38	38
EllettVA_151	995	24	1001	36	1
EllettVA_152	2597	48	1250	55	52
EllettVA_153	1193	23	1071	32	10
EllettVA_154	4060	130	3080	240	24
EllettVA_155	2703	30	1428	41	47
EllettVA_156	958	23	958	35	0
EllettVA_157	1418	28	1322	47	7
EllettVA_158	1372	43	1321	48	4
EllettVA_159	1203	22	1206	37	0
EllettVA_160	1333	22	1309	43	2
EllettVA_161	1262	34	1271	46	1
EllettVA_162	1248	27	1209	37	3
EllettVA_163	1429	35	1248	31	13
EllettVA_164	2773	37	1486	62	46
EllettVA_165	1060	20	1056	37	0
EllettVA_166	1045	20	1054	33	1
EllettVA_167	1149	23	1155	44	1
EllettVA_168	1055	21	1053	33	0
EllettVA_169	3114	61	1268	80	59
EllettVA_170	1468	21	1480	48	1
EllettVA_171	2525	45	1073	49	58
EllettVA_172	1048	19	1058	32	1

EllettVA_173	1166	24	1171	41	0
EllettVA_174	2226	38	870	40	61
EllettVA_175	1834	67	1135	39	38
EllettVA_176	1252	87	1050	52	16
EllettVA_177	1000	26	1003	39	0
EllettVA_178	1098	38	1064	40	3
EllettVA_179	1023	23	1022	37	0
EllettVA_180	1024	23	1036	33	1
EllettVA_181	2230	120	1335	86	40
EllettVA_182	2607	45	1330	56	49
EllettVA_183	1103	20	1130	33	2
EllettVA_184	2857	32	1155	42	60
EllettVA_185	3184	43	1366	70	57
EllettVA_186	3219	29	1329	44	59
EllettVA_187	1466	25	1469	50	0
EllettVA_188	1263	26	1032	28	18
EllettVA_189	3014	78	1420	110	53
EllettVA_190	2880	170	2120	130	26
EllettVA_191	1735	46	1343	43	23
EllettVA_192	1969	50	965	36	51
EllettVA_193	1439	32	1455	47	1
EllettVA_194	2834	42	1482	63	48
EllettVA_195	1295	39	1352	42	4
EllettVA_196	1297	32	1200	38	7
EllettVA_197	1188	25	1193	39	0
EllettVA_198	726	34	749	30	3
EllettVA_199	1979	49	1410	44	29
EllettVA_200	1231	25	1265	40	3

Table A10. U-Pb Ages: Gap Mills, WV Section

Sample ID	$^{207}Pb/^{235}U$ (Ma)	±2σ (Ma)	$^{206}Pb/^{238}U$ (Ma)	±2σ (Ma)	Discordance (%)
Plug 4					
GapMills_1	1436	52	1466	91	2
GapMills_2	1525	56	1386	80	9
GapMills_3	1464	53	1419	92	3
GapMills_4	1589	59	1620	100	2
GapMills_5	1541	51	1477	89	4
GapMills_6	1363	64	1330	86	2
GapMills_7	1471	52	1295	72	12
GapMills_8	553	44	487	35	12
GapMills_9	1649	58	1384	95	16
GapMills_10	1160	42	1120	64	3
GapMills_11	1073	34	1067	61	1
GapMills_12	1562	39	1624	70	4
GapMills_13	1523	50	584	38	62
GapMills_14	1277	58	1178	83	8
GapMills_15	1726	53	1760	110	2
GapMills_16	1662	52	1776	97	7
GapMills_17	1161	45	864	52	26
GapMills_18	1406	49	1182	59	16
GapMills_19	1279	46	1276	72	0
GapMills_20	1711	42	1321	70	23
GapMills_21	1528	48	1437	92	6
GapMills_22	1510	45	1179	70	22
GapMills_23	1167	39	1178	61	1
GapMills_24	1449	44	1447	72	0
GapMills_25	1829	39	555	32	70
Plug 5					
GapMills_1	1333	37	1323	47	1
GapMills_2	1435	45	1382	59	4
GapMills_3	1964	54	941	54	52
GapMills_4	1459	43	1416	71	3
GapMills_5	1731	52	1032	47	40
GapMills_6	1358	38	972	42	28
GapMills_7	1316	48	1057	48	20
GapMills_8	1317	33	1308	52	1
GapMills_9	1398	39	711	34	49
GapMills_10	1436	48	1391	57	3
GapMills_11	1763	38	774	30	56
GapMills_12	1352	44	1397	60	3
GapMills_13	1408	55	927	39	34
GapMills_14	1416	34	1373	47	3

GapMills_15	1391	43	1352	57	3
GapMills_16	1422	45	1373	56	3
GapMills_17	1271	48	1050	59	17
GapMills_18	1651	49	686	38	58
GapMills_19	1409	29	1298	54	8
GapMills_20	2523	62	2350	130	7
GapMills_21	1231	51	985	54	20
GapMills_22	1494	66	1104	65	26
GapMills_23	1453	47	1357	57	7
GapMills_24	1483	55	1463	81	1
GapMills_25	1480	45	973	60	34
GapMills_26	1783	51	810	50	55
GapMills_27	1653	65	654	40	60
GapMills_28	1643	50	1334	76	19
GapMills_29	2061	60	1133	61	45
GapMills_30	1449	51	1336	63	8
GapMills_31	1679	61	1402	66	16
GapMills_32	1106	62	1078	63	3
GapMills_33	1484	45	1465	59	1
GapMills_34	1639	56	499	35	70
GapMills_35	1645	32	488	18	70
GapMills_36	1548	58	1331	82	14
GapMills_37	1220	46	998	59	18
GapMills_38	993	36	950	64	4
GapMills_39	1551	57	1563	58	1
GapMills_40	1669	56	1131	71	32
GapMills_41	1650	65	854	61	48
GapMills_42	1348	74	512	36	62
GapMills_43	2443	60	1980	110	19
GapMills_44	6085	73	9910	380	63
GapMills_45	1705	49	1651	83	3
GapMills_46	1282	59	1130	65	12
GapMills_47	1752	55	1332	84	24
GapMills_48	1472	46	1236	67	16
GapMills_49	1544	49	1460	73	5
GapMills_50	1296	58	791	59	39
GapMills_51	1483	47	1004	58	32
GapMills_52	2193	56	988	61	55
GapMills_53	2750	67	1429	82	48
GapMills_54	2069	56	724	46	65
GapMills_55	1587	40	1134	56	29
GapMills_56	1802	55	938	51	48
GapMills_57	1695	51	1098	73	35
GapMills_58	1463	60	1148	72	22

GapMills_59	1500	58	1522	91	1
GapMills_60	1280	51	995	55	22
GapMills_61	1520	51	1259	70	17
GapMills_62	1576	55	576	29	63
GapMills_63	1616	59	697	45	57
GapMills_64	1451	54	1181	74	19
GapMills_65	1422	49	1071	65	25
GapMills_66	1575	49	1327	69	16
GapMills_67	1445	60	1480	100	2
GapMills_68	1302	45	1347	71	3
GapMills_69	1349	62	1011	67	25
GapMills_70	2095	42	1366	64	35
GapMills_71	1397	41	991	43	29
GapMills_72	1505	53	998	65	34
GapMills_73	1708	65	756	45	56
GapMills_74	1498	66	842	41	44
GapMills_75	5708	86	8040	370	41
GapMills_76	1314	68	734	52	44
GapMills_77	1758	57	949	57	46
GapMills_78	2020	65	1177	77	42
GapMills_79	1466	48	707	47	52
GapMills_80	2257	74	1267	97	44
GapMills_81	1810	54	1810	110	0
GapMills_82	1216	59	788	48	35
GapMills_83	1827	66	924	54	49
GapMills_84	1245	57	659	45	47
GapMills_85	1443	54	838	50	42
GapMills_86	2281	54	1462	90	36
GapMills_87	1763	69	902	68	49
GapMills_88	1772	54	793	41	55
GapMills_89	2087	52	1167	83	44
GapMills_90	1390	50	1031	52	26
GapMills_91	1409	60	1077	58	24
GapMills_92	1356	79	835	58	38
GapMills_93	1321	44	1326	68	0
GapMills_94	1539	86	1570	130	2

Table A11. U-Pb Ages: McGraw Gap, VA Section

Sample ID	$^{207}Pb/^{235}U$ (Ma)	±2σ (Ma)	$^{206}Pb/^{238}U$ (Ma)	±2σ (Ma)	Discordance (%)
Plug 8					
McGrawGap_1	1443	41	1532	54	6
McGrawGap_2	1478	38	1448	62	2
McGrawGap_3	1245	43	1317	82	6
McGrawGap_4	737	29	415	26	44
McGrawGap_5	1315	33	1143	56	13
McGrawGap_6	2980	63	1550	100	48
McGrawGap_7	487	32	471	32	3
McGrawGap_8	1207	38	1053	60	13
McGrawGap_9	1234	41	1262	54	2
McGrawGap_10	1635	52	1689	91	3
McGrawGap_11	1459	31	1548	55	6
McGrawGap_12	1453	44	1511	64	4
McGrawGap_13	1269	52	1337	92	5
McGrawGap_14	1475	52	1601	93	9
McGrawGap_15	1464	82	1221	75	17
McGrawGap_16	1242	45	1291	63	4
McGrawGap_17	1257	62	1286	69	2
McGrawGap_18	1785	41	755	52	58
McGrawGap_19	1460	38	1517	69	4
McGrawGap_20	1958	92	1950	150	0
McGrawGap_21	1148	47	993	52	14
McGrawGap_22	1381	43	1473	73	7
McGrawGap_23	1389	41	1267	54	9
McGrawGap_24	1246	41	1280	74	3
McGrawGap_25	3998	52	2870	140	28
McGrawGap_26	655	32	413	34	37
McGrawGap_27	1273	49	1276	50	0
McGrawGap_28	1541	44	1649	72	7
McGrawGap_29	1469	40	1538	58	5
McGrawGap_30	1091	45	946	53	13
McGrawGap_31	1201	40	1222	68	2
McGrawGap_32	1331	38	1387	62	4
McGrawGap_33	1622	56	1730	110	7
McGrawGap_34	1363	73	1360	120	0
McGrawGap_35	1414	51	1432	88	1
McGrawGap_36	1465	50	1338	77	9
McGrawGap_37	1605	48	1677	95	4
McGrawGap_38	1274	38	1346	54	6
McGrawGap_39	4435	73	3820	230	14
McGrawGap_40	1218	81	1176	64	3

McGrawGap_41	1236	79	1159	78	6
McGrawGap_42	1449	53	1577	65	9
McGrawGap_43	1207	48	1270	72	5
McGrawGap_44	1335	45	1465	85	10
McGrawGap_45	1186	67	1139	69	4
McGrawGap_46	4350	83	3620	300	17
McGrawGap_47	2045	77	1450	100	29
McGrawGap_48	1138	56	1128	57	1
McGrawGap_49	3452	75	2130	160	38
McGrawGap_50	1084	42	815	48	25
McGrawGap_51	501	26	85	6	83
McGrawGap_52	1441	51	1407	77	2
McGrawGap_53	571	57	485	31	15
McGrawGap_54	4965	62	5290	260	7
McGrawGap_55	1483	68	1585	93	7
McGrawGap_56	1570	40	1699	77	8
McGrawGap_57	1248	57	1182	65	5
McGrawGap_58	1320	59	1288	71	2
McGrawGap_59	1321	45	1334	73	1
McGrawGap_60	1299	46	1071	53	18
McGrawGap_61	1301	55	1428	82	10

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VITA

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