ACCURATE SPIN ASSIGNMENT TO THE 525 keV LEVEL IN 133Te

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The spin of 525 keV level is uncertain despite several measurements. The log ft value of β− decay from 123Sb allows three possibilities as 11/2, 9/2 or 7/2. The directional correlation coefficients of the 204γ−176γ cascade with the 204 keV depopulating the 525 keV level have been measured by several authors1. The measured coefficients favour 11/2 or 7/2 spins for this level and rule out 9/2 only. The nuclear orientation results are conflicting, however. Andrews et al.2 and Stone et al.3 favour only 11/2 or 9/2 whereas results of Krane et al.4 are consistent with all the three possibilities mentioned above. In view of this uncertain spin assignment it was decided to review the nature of transitions feeding and depopulating the 525 keV level.

The 525 keV level is fed by 116 keV transition and depopulated by 204 and 380. No other transition is worth consideration from intensity point of view. In the present work, intensities of the 116 and 380 keV gamma rays were measured with a 45 cc Ge (Li) detector for accurate conversion coefficient determination using our gamma intensities and conversion intensities given by Auble1. The experimental K-conversion coefficients for these two transitions are given here along with the possible theoretical conversion coefficients from the work of Hager and Seltzer5.

116 keV transition

\[ \sigma_k (\text{Expt.}) \quad \sigma_k (\text{EL}) \quad \sigma_k (\text{M2}) \]

0.076 (9) \quad 0.110 \quad 0.380

380 keV transition

\[ \sigma_k (\text{Expt.}) \quad \sigma_k (\text{M1}) \quad \sigma_k (\text{E2}) \]

0.014 (2) \quad 0.016 \quad 0.015

K/ L 6.2 (7) \quad 8.00 \quad 6.68

From the tables of Ferentz and Rosenzweig6 taking a spin sequence 7/2−, 7/2−, 11/2+ for this cascade

\[ A_2 (116 \text{ E1}) A_2 (380 \text{ E2}) = (-0.4364) (-0.2182) = 0.0952 \]

which is in perfect agreement with the above mentioned results. Thus 7/2− is precisely the spin of the 525 keV level.

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APATITE AGES OF SOME GRANITES OF MEGHALAYA

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FISSION track dating method has been applied by several workers11−13 for dating rock minerals. Apatite being a common accessory mineral in granites and easily etchable makes it suitable for such a study. In the present experiment, fission track ages and uranium concentration (U-conc.) of apatite grains from the Umroi granite*, the Mylliem granite and the South-Khasi batholith, Meghalaya have been determined by in situ measurement method.
Samples of the pink and grey porphyritic granites were collected from the granite plutons of Umroil, Mylliem and South-Khashi, Meghalaya. Thin sections of the rock samples were prepared and fixed on glass-slides with epoxy resin. These sections were polished in a polishing machine in two stages—first with aluminium powder of 400 μm and 800 μm and secondly by applying diamond paste of 8 μm, 3 μm and 1 μm successively. The polished sections were then etched in 6% HNO₃ at 26° C for 40 sec and fossil tracks were scanned with the help of a research model petrological microscope under high magnification (1200X). The scanned rock sections were then irradiated by a flux of thermal neutron (~10¹⁶ nvt) at CIRUS Reactor, Trombay.

**Table 1**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Fossil track density ρx10⁶/cm²</th>
<th>Induced track density ρx10⁶/cm²</th>
<th>Age m.y. (Million years)</th>
<th>Average age (m.y.)</th>
<th>U-conc. 10⁻⁶ gm/gm</th>
</tr>
</thead>
<tbody>
<tr>
<td>UG -1</td>
<td>0.94 (101)</td>
<td>7.63 (816)</td>
<td>647 ± 70</td>
<td>754 ± 25</td>
<td>3.17</td>
</tr>
<tr>
<td>-2</td>
<td>0.89 (150)</td>
<td>6.80 (1150)</td>
<td>680 ± 60</td>
<td>3.02</td>
<td>2.82</td>
</tr>
<tr>
<td>-3</td>
<td>1.13 (209)</td>
<td>6.28 (1162)</td>
<td>917 ± 70</td>
<td></td>
<td>2.61</td>
</tr>
<tr>
<td>-4</td>
<td>1.17 (111)</td>
<td>7.02 (794)</td>
<td>854 ± 76</td>
<td></td>
<td>2.92</td>
</tr>
<tr>
<td>-5</td>
<td>1.20 (127)</td>
<td>8.82 (936)</td>
<td>705 ± 70</td>
<td></td>
<td>3.66</td>
</tr>
<tr>
<td>-6</td>
<td>1.12 (221)</td>
<td>7.64 (1504)</td>
<td>757 ± 82</td>
<td></td>
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<tr>
<td>-7</td>
<td>1.09 (109)</td>
<td>5.65 (564)</td>
<td>979 ± 108</td>
<td></td>
<td>2.35</td>
</tr>
<tr>
<td>-8</td>
<td>1.18 (191)</td>
<td>7.28 (1179)</td>
<td>832 ± 70</td>
<td></td>
<td></td>
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<tr>
<td>-9</td>
<td>0.73 (117)</td>
<td>6.11 (902)</td>
<td>623 ± 70</td>
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<td>2.54</td>
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<tr>
<td>-10</td>
<td>1.30 (88)</td>
<td>8.38 (579)</td>
<td>798 ± 98</td>
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<td>3.48</td>
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<tr>
<td>-11</td>
<td>1.30 (104)</td>
<td>9.43 (776)</td>
<td>714 ± 76</td>
<td></td>
<td>3.92</td>
</tr>
<tr>
<td>-12</td>
<td>0.85 (59)</td>
<td>7.07 (559)</td>
<td>627 ± 76</td>
<td></td>
<td>2.94</td>
</tr>
<tr>
<td>-13</td>
<td>1.30 (101)</td>
<td>9.43 (779)</td>
<td>714 ± 76</td>
<td></td>
<td>3.92</td>
</tr>
<tr>
<td>-14</td>
<td>1.30 (70)</td>
<td>9.44 (768)</td>
<td>713 ± 60</td>
<td></td>
<td>3.92</td>
</tr>
<tr>
<td>MG -1</td>
<td>0.97 (226)</td>
<td>3.16 (739)</td>
<td>602 ± 39</td>
<td></td>
<td>3.50</td>
</tr>
<tr>
<td>-2</td>
<td>1.05 (315)</td>
<td>3.02 (906)</td>
<td>678 ± 43</td>
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<td>3.45</td>
</tr>
<tr>
<td>-3</td>
<td>1.10 (273)</td>
<td>3.30 (818)</td>
<td>651 ± 51</td>
<td></td>
<td>3.66</td>
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<tr>
<td>-4</td>
<td>1.04 (274)</td>
<td>2.35 (618)</td>
<td>851 ± 71</td>
<td></td>
<td>2.60</td>
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<tr>
<td>-5</td>
<td>1.37 (276)</td>
<td>3.86 (780)</td>
<td>691 ± 43</td>
<td></td>
<td>4.28</td>
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<tr>
<td>-6</td>
<td>1.46 (363)</td>
<td>3.11 (775)</td>
<td>900 ± 51</td>
<td></td>
<td>3.45</td>
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<tr>
<td>-7</td>
<td>1.66 (331)</td>
<td>3.96 (788)</td>
<td>809 ± 46</td>
<td></td>
<td>4.39</td>
</tr>
<tr>
<td>-8</td>
<td>1.45 (363)</td>
<td>3.64 (910)</td>
<td>771 ± 43</td>
<td></td>
<td>4.03</td>
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<tr>
<td>-9</td>
<td>1.57 (211)</td>
<td>3.52 (472)</td>
<td>858 ± 61</td>
<td></td>
<td>3.90</td>
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<tr>
<td>-10</td>
<td>1.06 (238)</td>
<td>2.87 (646)</td>
<td>718 ± 49</td>
<td>767 ± 19</td>
<td>3.18</td>
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<tr>
<td>-11</td>
<td>1.36 (210)</td>
<td>3.50 (539)</td>
<td>753 ± 55</td>
<td></td>
<td>3.88</td>
</tr>
<tr>
<td>-12</td>
<td>0.97 (226)</td>
<td>2.35 (550)</td>
<td>797 ± 68</td>
<td></td>
<td>2.60</td>
</tr>
<tr>
<td>-13</td>
<td>1.46 (363)</td>
<td>3.53 (879)</td>
<td>799 ± 49</td>
<td></td>
<td>3.91</td>
</tr>
<tr>
<td>-14</td>
<td>1.35 (324)</td>
<td>3.05 (732)</td>
<td>852 ± 59</td>
<td></td>
<td>3.38</td>
</tr>
<tr>
<td>SK -1</td>
<td>1.28 (119)</td>
<td>1.03 (96)</td>
<td>818 ± 105</td>
<td></td>
<td>3.34</td>
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<tr>
<td>-2</td>
<td>1.08 (113)</td>
<td>0.94 (99)</td>
<td>760 ± 111</td>
<td></td>
<td>3.05</td>
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<tr>
<td>-3</td>
<td>1.39 (188)</td>
<td>1.20 (162)</td>
<td>766 ± 77</td>
<td></td>
<td>3.89</td>
</tr>
<tr>
<td>-4</td>
<td>0.89 (176)</td>
<td>0.93 (184)</td>
<td>639 ± 77</td>
<td></td>
<td>3.02</td>
</tr>
<tr>
<td>-5</td>
<td>0.67 (85)</td>
<td>0.74 (94)</td>
<td>606 ± 70</td>
<td>737 ± 28</td>
<td>2.40</td>
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<tr>
<td>-6</td>
<td>0.72 (58)</td>
<td>0.74 (59)</td>
<td>650 ± 77</td>
<td></td>
<td>2.40</td>
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<tr>
<td>-7</td>
<td>0.82 (51)</td>
<td>1.99 (123)</td>
<td>797 ± 104</td>
<td></td>
<td>2.20</td>
</tr>
<tr>
<td>-8</td>
<td>0.80 (136)</td>
<td>1.83 (311)</td>
<td>842 ± 74</td>
<td></td>
<td>2.03</td>
</tr>
<tr>
<td>-9</td>
<td>0.84 (92)</td>
<td>2.16 (238)</td>
<td>754 ± 80</td>
<td></td>
<td>2.39</td>
</tr>
</tbody>
</table>

Number of tracks counted are shown parenthetically. Only the statistical errors of counting are shown in column 4, whereas in column 5, mean values with standard errors are given.
The irradiated samples were polished, etched and then tracks were counted under the same magnification. The estimation of neutron dose was made with the help of standard glass exposed to neutron flux simultaneously along with the rock sections.

The fission track age (T) and uranium concentration (C) of the apatite grains were determined using the following relations:\footnote{\textit{La}}:

\[ T = \frac{1}{\lambda_D} \ln \left[ 1 + \frac{P \phi}{\lambda_f \lambda D} \right] \]  \hspace{1cm} (1)

where \( \lambda_D \), \( \lambda_f \), \( \phi \), \( P \) are constants.

\[ C = K_A \frac{P}{\phi} \]  \hspace{1cm} (2)

e, e, \phi \) are fossil track density, induced track density and neutron dose respectively. The experimental data on the fossil track densities, induced track densities and inferred ages are given in table 1.

The following are the estimated neutron dose for the granites:

- \textbf{Umroi Granite (UG)} = (8.89 ± 0.17) \times 10^{16} \text{ nvt}
- \textbf{Mylliem Granite (MG)} = (3.34 ± 0.007) \times 10^{16} \text{ nvt}
- \textbf{South-Khass Granite (SK)} = (1.14 ± 0.04) \times 10^{16} \text{ nvt}

The age parameter from each thin section, shown in column 4 in table 1, is computed by adding the fossil tracks, the induced tracks and the corresponding areas on all the grains in the section. This was done to reduce the statistical error\footnote{\textit{La}}.

The final result of the present study shows that the average apatite ages of the Umroi granite, the Mylliem granite and the South-Khass batholith are (754 ± 25) m.y., (767 ± 19) m.y. and (737 ± 28) m.y. respectively. The U-conc. as obtained in the present experiment is shown in the column 6, table 1.

It may be pertinent to mention that there is no geochronological data on the Umroi granite and the South-Khass batholith. However, Crawford\footnote{\textit{La}} determined the age of the Mylliem granite by Rb/Sr method and found to be (765 ± 10) m.y. The present study shows that the three granite plutons of separate occurrences may be linked with the same cycle of igneous activity.

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\begin{thebibliography}{9}

3. Talukdar, B. C., Pathak, K. M., Chakravarty, A.

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